Cask/MSC/WP Preparation System Description Document

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DISCLAIMER

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3. SDD Title
Cask/MSC/WP Preparation System Description Document

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14. Revision No.	15. Description of Change
000	The basis for Rev. 000 of this SDD is the Cask/MSC/WP Preparation System Description Document (COGEMA-C0115-EN-SDD-002, Rev. 2 (DIRS 167196)). The current document supercedes the COGEMA document and is a complete revision due to requirements and formatting changes to conform to the requirements of Rev. 1 ICN4 of LP-3.26Q-BSC.
001	This revision incorporates the latest changes provided from the preclosure safety analyses, PDC (Rev. 2), *Q-List* (Rev. 1), *Nuclear Safety Design Bases for License Application* (Rev. 1), and F&OR (Rev. 2). This SDD revision resolves CA 4552-001 for CR 4552.

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ACRONYMS AND ABBREVIATIONS

ALARA	as low as is reasonably achievable
CCC	Central Control Center
CHF	Canister Handling Facility
CSNF	commercial spent nuclear fuel
DBGM	design basis ground motion
DPC	dual-purpose canister
DOE	U.S. Department of Energy
DTF	Dry Transfer Facility
F&OR	*Project Functional and Operational Requirements*
FHF	Fuel Handling Facility
FMEA	failure mode and effects analysis
HLW	high-level (radioactive) waste
HVAC	heating, ventilation, and air-conditioning
ITS	important to safety
LWT	legal weight truck
MSC	monitored geologic repository site-specific cask
NNPP	Naval Nuclear Propulsion Program
OWT	overweight truck
PDC	*Project Design Criteria Document*
PRD	*Project Requirements Document*
SC	safety category
SDD	system description document
SNF	spent nuclear fuel
SRTC	site rail transfer cart
SSC	structure, system, or component
WP	waste package

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1. INTRODUCTION

The purpose of this system description document (SDD) is to establish requirements that drive the design of the Cask/MSC/WP preparation system and their bases to allow the design effort to proceed to license application. This SDD is a living document that will be revised at strategic points as the design matures over time. This SDD identifies the requirements and describes the system design, as they exist at this time, with emphasis on those attributes of the design provided to meet the requirements. This SDD has been developed to be an engineering tool for design control. Accordingly, the primary audience and users are design engineers. This type of SDD both leads and trails the design process. It leads the design process with regard to the flow down of upper tier requirements onto the system. Knowledge of these requirements is essential in performing the design process. This SDD trails the design with regard to the description of the system. The description provided in the SDD is a reflection of the results of the design process to date.

This SDD addresses the *Project Requirements Document* (PRD) (Canori and Leitner 2003 [DIRS 166275]) requirements. Additional PRD requirements may be cited, as applicable, to drive the design of specific aspects of the system, with justifications provided in the basis. Functional and operational requirements applicable to this system are obtained from the *Project Functional and Operational Requirements* (F&OR) (Curry 2004 [DIRS 170557]) document. Other requirements to support the design process have been taken from higher-level requirements documents such as the *Project Design Criteria Document* (PDC) (BSC 2004 [DIRS 171599] and the preclosure safety analyses.

This SDD contains several appendices that include supporting information. Appendix A includes the Glossary; Appendix B lists key system charts, diagrams, drawings, lists, and additional supporting information; and Appendix C includes a list of system procedures.

1.1 SYSTEM IDENTIFICATION

The Cask/MSC/WP preparation system encompasses the necessary subsystems, functions, and structures, systems, or components (SSCs) to receive and prepare source transportation casks and destination waste packages for the transfer of commercial spent nuclear fuel (CSNF), U.S. Department of Energy (DOE) managed spent nuclear fuel (SNF)/high-level radioactive waste (HLW), and naval SNF.

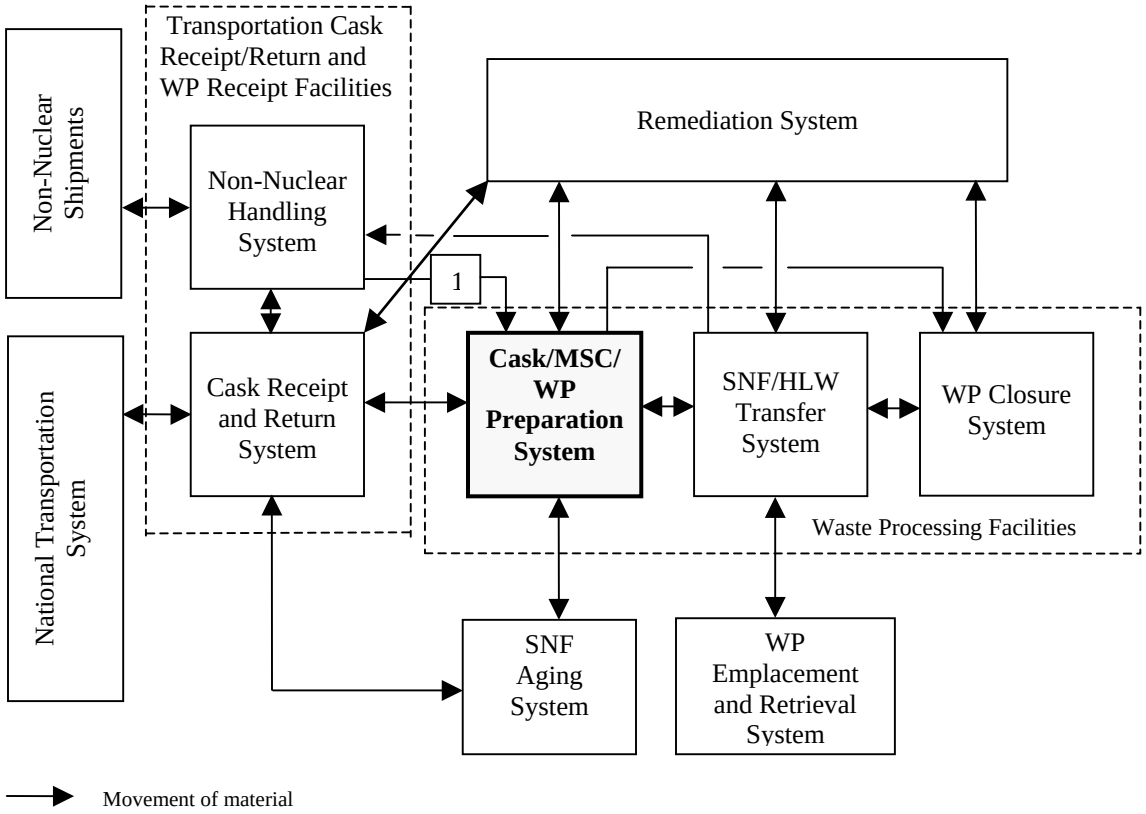
The source casks are the loaded transportation casks or site-specific casks. The casks will contain CSNF, DOE SNF/HLW, or naval SNF. The destination containers are the empty waste packages or empty or unloaded site-specific casks. The following sections describe the subsystems of the Cask/MSC/WP preparation system:

- Cask preparation subsystem
- Waste package preparation subsystem
- Cask restoration subsystem.

The system is housed inside the Dry Transfer Facility (DTF), Canister Handling Facility (CHF), and Fuel Handling Facility (FHF). The DTF, CHF, and FHF are referred to in this document as waste processing facilities. Note that references to the DTF apply to both DTF 1 and DTF 2, which are identical facilities. The system interfaces with the repository site systems that perform or support waste processing operations. The system also interfaces with the following systems and facilities:

- Cask receipt and return system
- SNF/HLW transfer system
- Remediation system
- Waste package closure system
- SNF aging system
- Non-nuclear handling system (FHF only)
- Digital control and management information system
- Radiation/radiological monitoring system
- Electrical power system
- Electrical support system
- Plant services system
- Communications system
- Safeguards and security system
- Surface nuclear heating, ventilation, and air-conditioning (HVAC) system
- DTF (houses the system)
- CHF (houses the system)
- FHF (houses the system)
- Balance of Plant Facility
- Remediation Facility
- Low-level radioactive waste management system
- Low-level radioactive waste generating system
- Non-radiological waste management system.

Figure 1-1 provides a view of how the flow of material through the Cask/MSC/WP preparation system interfaces with other process systems of the repository.



NOTE: (1) Waste packages and empty site-specific casks are delivered directly to the FHF from the non-nuclear handling system.

Figure 1-1. Process System Identification and Flow of Material with other Mechanical Handling Systems

1.2 LIMITATIONS OF THIS SYSTEM DESCRIPTION DOCUMENT

This SDD may include assumptions, preliminary information, and to be verified values, as appropriate, to the current level of design development. Additionally, requirements or descriptions stated as to be determined items that are expected at a later phase of the design will be described as such.

At the time this version of the SDD is approved, the design status is such that the conceptual design has been completed and the preliminary design has been started. As the necessary design documents (calculations, drawings, specifications, and other supporting documents) are completed, the description of the system design will be updated.

1.3 OWNERSHIP OF THIS SYSTEM DESCRIPTION DOCUMENT

This Cask/MSC/WP preparation system SDD is owned by the Mechanical Handling and Waste System Group of Design and Engineering.

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2. OVERVIEW

This section lists the functions of the Cask/MSC/WP preparation system that are traceable to the requirements in the F&OR (Curry 2004 [DIRS 170557]) and PRD (Canori and Leitner 2003 [DIRS 166275]). The following subsections also document a determination of the system classification and provide an overview of the system operation.

2.1 STRUCTURE, SYSTEM, OR COMPONENT FUNCTIONS

The Cask/MSC/WP preparation system is described as follows in Section 1.1.2.1 of the F&OR (Curry 2004 [DIRS 170557]) document:

> "The Prepare Transportation Casks, WPs, MSCs, and DPCs for SNF/HLW Transfer function embodies all activities to prepare casks, WPs, MSCs, and DPCs for transfer operations, including accessing the inside of the cask or DPC, positioning the respective component for transfer operations, and achieving radiological confinement with the transfer area."

Accessing the inside of a dual-purpose canister (DPC) will be performed by the SNF/HLW transfer system and is not addressed in this SDD.

The basic functions performed by the system are:

- Prepare loaded transportation casks (incoming from cask and receipt system)
- Prepare empty waste packages (incoming from cask and receipt system)
- Prepare unloaded site-specific casks (incoming from SNF aging system)
- Restore unloaded transportation casks (outgoing to cask and receipt system)
- Prepare loaded site-specific cask (outgoing to SNF aging system)
- Recover from off-normal events
- Prepare empty site-specific casks (incoming from cask and receipt system)
- Prepare loaded site-specific casks (incoming from SNF aging system)
- Restore unloaded site-specific casks (outgoing to SNF aging system).

System functional requirements from the F&OR (Curry 2004 [DIRS 170557]) are summarized in the subsection titles. The implementing performance and operational requirements are described in each subsection and the source of each requirement from the F&OR is shown in brackets at the end of the basis statement.

2.1.1 Prepare Loaded Transportation Casks

The prepare loaded transportation casks function will survey, disassemble, stage, and remediate, as required, incoming waste shipments. This function ensures that incoming shipments, in off-normal conditions, are properly treated prior to entering the SNF/HLW transfer system. This function begins with a received transportation cask and transport vehicle and ends with the transportation cask ready for SNF/HLW transfer operations (Curry 2004 [DIRS 170557], Section 1.1.2.1.1).

The waste shipments arrive in an entrance vestibule in loaded transportation casks. Loaded transportation casks are received from the cask receipt and return system.

2.1.2 Prepare Empty Waste Packages

The prepare empty waste packages function will receive, stage lids, and install docking rings, if required. This function begins with a received empty waste package and ends with the empty waste package ready for SNF/HLW transfer operations (Curry 2004 [DIRS 170557], Section 1.1.2.1.2).

2.1.3 Prepare Unloaded Site-Specific Casks

The prepare unloaded site-specific casks function includes receiving, preparing lids, and installing docking rings, if required. This function begins with an unloaded site-specific cask received from the SNF aging system and ends with the site-specific cask ready for SNF transfer operations (Curry 2004 [DIRS 170557], Section 1.1.2.1.3).

2.1.4 Restore Unloaded Transportation Casks

The restore unloaded transportation casks function includes removing docking rings, if used, securing lids, and inspections. This function begins with an unloaded transportation cask and ends with the cask returned to the cask transport vehicle and ready for redeployment through the cask receipt and return system (Curry 2004 [DIRS 170557], Section 1.1.1.5).

2.1.5 Prepare Loaded Site-Specific Casks (*Outgoing*)

The prepare loaded site-specific casks function includes removing docking rings, if used, securing lids, and inerting. This function begins with a loaded site-specific cask and ends with the site-specific cask ready for transfer to the SNF aging system (Curry 2004 [DIRS 170557], Section 1.1.2.2).

2.1.6 Recover from Off-Normal Events

The recover from off-normal events function includes those system features and equipment for reducing the risk of, responding to, and recovering from off-normal events and credible event sequences and ensures the continued operation of the repository while maintaining the required levels of safety and security (Curry 2004 [DIRS 170557], Section 1.1-4).

2.1.7 Prepare Empty Site-Specific Casks

The prepare empty site-specific casks function includes receiving, disassembling, staging lids, and installing docking rings, if required. This function begins with a received empty site-specific cask from the cask receipt and return system and ends with the empty site-specific cask ready for SNF transfer operations (Curry 2004 [DIRS 170557], Section 1.1.2.1.3).

2.1.8 Prepare Loaded Site-Specific Casks (*Incoming*)

The prepare loaded site-specific casks function includes receiving, sampling, preparing lids, and installing docking rings, if required. This function begins with receiving a loaded site-specific cask from the SNF aging system and ends with the loaded site-specific cask ready for SNF/HLW transfer operations (Curry 2004 [DIRS 170557], Section 1.1.2.1.3).

2.1.9 Restore Unloaded Site-Specific Casks

The restore unloaded site-specific cask function includes removing docking rings, if used, securing lids, and inspections. This function begins with an unloaded site-specific cask and ends with the cask returned to the SNF aging system (Curry 2004 [DIRS 170557], Section 1.1.5.1-1).

2.2 STRUCTURE, SYSTEM, OR COMPONENT CLASSIFICATION

In accordance with the *Q-List* (BSC 2005 [DIRS 171190]), the Cask/MSC/WP preparation system is important to safety (ITS) and this system contains ITS SSCs. Therefore, this system is safety category (SC).

Additional information regarding system classification may be found in *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512]).

2.3 OPERATIONAL OVERVIEW

The Cask/MSC/WP preparation system consists of SSCs necessary to receive transportation casks, waste packages, and site-specific casks at the waste processing facilities and to prepare them for waste transfer operations. The system also prepares unloaded transportation casks, loaded and unloaded site-specific casks for leaving the waste processing facilities, and restores unloaded transportation casks and site-specific casks for return to service. The three subsystems of the Cask/MSC/WP preparation system are:

- Cask preparation subsystem
- Waste package preparation subsystem
- Cask restoration subsystem.

An operational overview of each subsystem is provided below. Further details of each subsystem are provided in Section 4.

2.3.1 Cask Preparation Subsystem

Dry Transfer Facility

Within the DTF, the cask preparation subsystem is designed to perform the following functions:

- Receive loaded transportation casks and empty site-specific casks from the cask receipt and return system on site rail transfer carts (SRTCs)

- Receive loaded and unloaded site-specific casks from the SNF aging system

- Prepare loaded transportation casks and loaded, unloaded, and empty site-specific casks for waste transfer operations.

The transportation cask impact limiters and personnel barriers are removed, as required, and the transportation cask or site-specific cask is moved to a trolley that has been configured for the cask or site-specific cask being received. The trolley is moved to various locations in the DTF where transportation cask/site-specific cask preparation operations are performed.

The transportation cask/site-specific cask preparation activities include gas sampling, venting, unbolting lids, and installing docking rings. Docking rings are not installed on naval casks. The actual docking of the transportation cask/site-specific cask to the waste transfer cell is performed by the SNF/HLW transfer system.

Canister Handling Facility

Within the CHF, the cask preparation subsystem is designed to perform the following functions:

- Receive loaded transportation casks from the cask receipt and return system
- Receive empty site-specific casks from the cask receipt and return system
- Receive unloaded site-specific casks from the SNF aging system
- Prepare loaded transportation casks and loaded, unloaded, and empty site-specific casks for waste transfer operations.

Loaded transportation casks are received on SRTCs, legal weight trucks (LWTs), overweight trucks (OWTs), or other conveyance by the cask receipt and return system. Empty site-specific casks arrive on SRTCs from the cask receipt and return system and loaded or unloaded site-specific casks are received from the SNF aging system. Loaded or unloaded site-specific casks are moved using site-specific cask transporters. Transportation cask personnel barriers and impact limiters are removed, as required and a cask inspection and radiation survey performed. Casks and site-specific casks are moved to the canister transfer cell where tie-downs and stabilizers are removed. Casks are then upended and placed inside a designated pit inside the transfer cell for cask preparations. Casks are prepared for transfer operations inside the pit including gas sampling and venting for loaded casks and lid unbolting. The SNF/HLW transfer system performs the waste transfer.

Fuel Handling Facility

Within the FHF, the cask preparation subsystem is designed to perform the following functions:

- Receive loaded transportation casks from the cask receipt and return system
- Receive loaded and unloaded site-specific casks from the SNF aging system

- Receive empty site-specific casks from the non-nuclear handling system
- Prepare loaded transportation casks, loaded site-specific casks, unloaded site-specific casks, and empty site-specific casks for waste transfer operations.

Loaded transportation casks containing bare CSNF are delivered by railcar or truck trailer by the cask receipt and return system. The transportation cask impact limiters, tie-downs, and personnel barriers are removed, as required, and the transportation cask is upended and moved to the import-export trolley. The import-export trolley is then moved to the preparation area where the cask is prepared for SNF transfer. The import-export trolley is then moved to the main transfer room. The cask is transferred to the transfer trolley and the docking ring is installed. The transfer trolley is typically moved to the fuel transfer room docking port in the Fuel Transfer Bay #2 for waste transfer. The SNF/HLW transfer system performs the waste transfer.

Loaded transportation casks, containing DOE SNF/HLW canisters, naval canisters, or DPCs are delivered by railcar or truck trailer by the cask receipt and return system. The transportation cask impact limiters, tie-downs, and personnel barriers are removed, as necessary, and the transportation cask is upended, placed on the import-export trolley, and moved to a canister transfer station where the cask is prepared for waste transfer.

Loaded site-specific casks are delivered from the SNF aging system and are prepared similar to the transportation casks for fuel transfer. Loaded site-specific casks will typically be moved to the fuel transfer room docking port in the Fuel Transfer Bay #3 for waste transfer.

The transportation cask/site-specific cask preparation activities include gas sampling, venting, unbolting lids, and installing docking rings. Installation of docking rings is not part of the cask preparation activities for transportation casks containing DOE SNF/HLW canisters, naval canisters, or DPCs.

2.3.2 Waste Package Preparation Subsystem

Dry Transfer Facility

Within the DTF, the waste package preparation subsystem is designed to perform the following functions:

- Receive empty waste packages and waste package lids from the cask receipt and return system on SRTCs
- Transfer empty waste packages from the SRTCs to waste package trolleys
- Move waste package trolleys to the waste package preparation room
- Prepare waste packages for docking to the waste transfer cell.

Receipt of waste packages occurs at the waste package/naval cask SRTC receipt area or waste package SRTC receipt area of the DTF for processing in two lines. Upon receipt, the lids of a waste package are dispersed with the inner lid remaining in the waste package and the middle

and outer lids going to the waste package closure cells. The 50-ton waste package handling cranes lift the waste package onto a waste package trolley fitted with a pedestal specific to the waste package type. The waste package trolley moves the waste package to the waste package/naval cask preparation room or waste package preparation room where docking rings are installed (except for waste packages receiving naval canisters). The waste package trolleys proceed to waste package docking cells for loading all waste forms (except naval canisters). Naval canisters are loaded in the waste package loading/docking ring removal cell. The SNF/HLW system performs the waste transfer.

Canister Handling Facility

Within the CHF, the waste package preparation subsystem is designed to perform the following functions:

- Receive empty waste packages and waste package lids from the cask receipt and return system on SRTCs
- Prepare empty waste packages for waste canister transfer operations.

Empty waste packages are received on SRTCs from the cask receipt and return system. Waste packages are received at the entrance vestibule. An empty waste package with the inner lid is moved to the canister transfer cell. The inner waste package lid remains in the waste package. The middle and outer waste package lids are moved to the waste package closure cells. The empty waste package is placed inside a designated pit. The shield doors are closed and the waste package is ready for waste loading. The SNF/HLW transfer system performs the waste transfer.

Fuel Handling Facility

Within the FHF, the waste package preparation subsystem is designed to perform the following functions:

- Receive empty waste packages and waste package lids from the non-nuclear handling system on a railcar or truck trailer
- Move waste packages from the railcar or truck trailer to the import-export trolley and from the import-export trolley to the waste package transfer trolley
- Prepare waste packages for docking to the fuel transfer room
- Prepare waste packages for canister transfer operations.

The empty waste package, lids, and spread rings are delivered to the entrance vestibule. The inner waste package lid remains in the waste package. The middle and outer waste package lids are transferred to the closure cell. The waste package is transferred from the conveyance to the import-export trolley and moved to the preparation room where the waste package is prepared for fuel transfer. The waste package and trolley are then moved to the main transfer room and the waste package is moved to the transfer trolley and docking rings are installed. The waste package is moved to the Fuel Transfer Bay #1 under the docking port of the fuel transfer room.

For canister transfer, the waste package is moved from the import-export trolley to the canister transfer station. The SNF/HLW transfer system performs the waste transfer.

2.3.3 Cask Restoration Subsystem

Dry Transfer Facility

Within the DTF, the cask restoration subsystem is designed to perform the following functions:

- Receive unloaded transportation casks from the SNF/HLW transfer system after waste transfer operations
- Receive loaded and unloaded site-specific casks from the SNF/HLW transfer system after waste transfer operations
- Restore the unloaded transportation casks for transferring to the cask receipt and return system
- Prepare the loaded and unloaded site-specific casks for transferring to the SNF aging system.

The cask restoration subsystem receives unloaded transportation casks, unloaded site-specific casks, and loaded site-specific casks after the completion of waste transfer operations.

The cask restoration process prepares the transportation cask for offsite transport. Cask restoration activities include docking ring removal, bolting lid(s), inspections, decontamination, reinstalling impact limiters, reinstalling personnel barriers (as required), inerting and leak testing loaded site-specific casks.

Unloaded transportation casks are sent to the cask receipt and return system on an SRTC. Unloaded and loaded site-specific casks are sent to the SNF aging system on a cask transporter.

Canister Handling Facility

Within the CHF, the cask restoration subsystem is designed to perform the following functions:

- Receive unloaded transportation casks from the SNF/HLW transfer system after canister transfer operations
- Receive loaded and unloaded site-specific casks from the SNF/HLW transfer system after canister transfer operations
- Restore the unloaded transportation casks for transferring to the cask receipt and return system
- Prepare the loaded and unloaded site-specific casks for transferring to the SNF aging system.

The cask restoration subsystem receives unloaded transportation casks, unloaded site-specific casks, and loaded site-specific casks after completion of canister transfer operations. Loaded site-specific casks are moved to the SNF aging system. Unloaded site-specific casks are moved to the SNF aging system for storage.

The cask restoration process prepares the unloaded transportation cask for offsite transport. Decontamination is not required because the canistered waste is not expected to result in external and internal cask contamination. Cask restoration activities include bolting lid(s), inspections, reinstalling impact limiters, reinstalling personnel barriers (as required), inerting and leak testing loaded site-specific casks.

Fuel Handling Facility

Within the FHF, the cask restoration subsystem is designed to perform the following functions:

- Receive unloaded transportation casks from the SNF/HLW transfer system after bare fuel transfer operations or canister transfer operations
- Receive loaded and unloaded site-specific casks from the SNF/HLW transfer system after fuel transfer operations
- Restore the unloaded transportation cask for transferring to the cask receipt and return system
- Prepare the loaded and unloaded site-specific casks for transferring to the SNF aging system.

The cask restoration subsystem receives unloaded transportation casks and loaded and unloaded site-specific casks after completion of transfer operations. Transportation casks are prepared for offsite transport. Loaded and unloaded site-specific casks are prepared for transfer to the SNF aging system. For loaded site-specific casks, additional steps include filling the site-specific casks with an inert gas and performing leak tests.

3. REQUIREMENTS AND BASES

All requirements referencing *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512]) are classified as 10 CFR Part 63 [DIRS 173164] requirements and are located in Section 3.1.1.1. The remaining requirements and associated bases are classified as external compliance unless noted within the appropriate comment section. The source of each requirement is shown in brackets at the end of the basis statement.

Note: The definitions of safety functions delineated by quotation marks are contained in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512].

3.1 GENERAL REQUIREMENTS

3.1.1 System Functional Requirements

This section describes the system safety requirements, environmental requirements, mission-critical requirements, and general requirements.

3.1.1.1 Safety Requirements

Safety requirements in Section 3.1.1.1 are nuclear design bases from Table A-II of the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512]). Other requirements that address safety issues, such as personnel protection from process industrial hazards or nuclear criticality safety requirements, are contained in the special requirements section or other topical sections below.

3.1.1.1.1 Requirement: The drop rate for cranes involved in handling waste forms and their associated containers shall be less than or equal to 1×10^{-5} drops/transfer, regardless of cause, including human error, failure of equipment such as yokes and grapples, or a combination of the two. This requirement applies to the CHF cask handling crane, DTF cask handling crane, DTF naval cask handling crane, FHF entrance vestibule crane, FHF main transfer room crane, and CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.2 Requirement: Upon a loss of power, this crane shall be designed to stop, retain its load, and enter a locked mode. Upon a restoration of power, this crane shall stay in the locked mode until operator action is taken. This requirement applies to the CHF cask handling crane, DTF cask handling crane, DTF naval cask handling crane, FHF entrance vestibule crane, FHF main transfer room crane, and CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: Requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.3 Requirement: The probability of dropping handling equipment from a crane onto a canister shall be less than or equal to 1×10^{-5} for each canister transferred. This requirement

applies to the FHF main transfer room crane and CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.4 Requirement: The conditional probability of the crane exceeding a lift-height limit, given that a drop has occurred, shall be less than or equal to 1×10^{-4}. This requirement applies to the CHF cask handling crane, DTF cask handling crane, DTF naval cask handling crane, FHF entrance vestibule crane, FHF main transfer room crane, and CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.5 Requirement: The lift height limits for the casks handled by the crane are provided in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table C-1). This requirement applies to the CHF cask handling crane. Supports Function 2.1.6.

The casks handled by the crane include:

1. Transportation casks without impact limiters containing naval SNF canisters
2. Transportation casks without impact limiters containing standardized DOE SNF canisters
3. Transportation casks without impact limiters containing DOE HLW canisters and commercial SNF in vertical DPCs
4. Transportation casks without impact limiters containing a DOE multi-canister overpack (MCO)
5. Site-specific casks with vertical DPCs.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.6 Requirement: The lift height limits for the casks handled by the crane are provided in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table C-1). This requirement applies to the DTF cask handling crane. Supports Function 2.1.6.

The casks handled by the crane include:

1. Transportation casks without impact limiters containing standardized DOE SNF canisters, DOE HLW canisters, commercial SNF, or vertical or horizontal DPCs
2. Site-specific casks containing commercial SNF or vertical or horizontal DPCs
3. Transportation casks without impact limiters containing a DOE MCO

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.7 Requirement: The lift height limit for the transportation casks without impact limiters containing a naval SNF is provided in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table C-1). This requirement applies to the DTF naval cask handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.8 Requirement: The lift height limits for the casks handled by the crane are provided in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table C-1). This requirement applies to the FHF entrance vestibule crane. Supports Function 2.1.6.

The casks handled by the crane include:

1. Transportation cask without impact limiters containing naval SNF canisters
2. Transportation cask without impact limiters containing standardized DOE SNF canisters or DOE HLW canisters
3. Transportation cask without impact limiters or site-specific cask containing commercial SNF or DPCs

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.9 Requirement: The lift height limits for the casks, canisters, and waste packages handled by the crane are provided in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table C-1). This requirement applies to the FHF main transfer room crane. Supports Function 2.1.6.

The casks, canisters, and waste packages handled by the crane include:

1. Transportation casks without impact limiters, including casks containing naval SNF canisters, DOE HLW canisters, standardized DOE SNF canisters, vertical DPCs, and commercial SNF
2. Site-specific casks containing commercial SNF or vertical DPCs
3. Naval SNF canisters
4. DOE HLW canisters, standardized DOE SNF canisters, and vertical DPCs
5. Unsealed, loaded waste packages
6. Sealed waste packages
7. Sealed waste packages in a horizontal orientation on an emplacement pallet.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.10 Requirement: The lift height limits for the canisters and waste packages handled by the crane are provided in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table C-1). This requirement applies to the CHF waste package and canister handling crane. Supports Function 2.1.6.

The canisters and waste packages handled by the crane include:

1. Naval SNF canisters, standardized DOE SNF canisters, DOE MCOs, or DOE HLW canisters
2. Vertical DPCs
3. Unsealed waste packages containing standardized DOE SNF canisters, DOE HLW canisters, naval SNF canisters, or DOE MCOs
4. Sealed waste packages containing standardized DOE SNF canisters, DOE HLW canisters, naval SNF canisters, or DOE MCOs
5. Sealed waste packages in a horizontal orientation on an emplacement pallet.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.11 Requirement: The crane and its rigging shall be designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate sufficient seismic design margin to ensure that a "no drop" safety function is maintained for loading conditions associated with a BDBGM seismic event. This requirement applies to the CHF cask handling crane, DTF cask handling crane, DTF naval cask handling crane, FHF entrance vestibule crane, FHF main transfer room crane, and CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.12 Requirement: The crane shall not be capable of moving above a speed limit for overhead crane transfers such that a collision at the speed limit would not breach a transportation cask or site-specific cask. This requirement applies to the CHF cask handling crane, DTF cask handling crane, and FHF entrance vestibule crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.13 Requirement: The crane shall not be capable of moving above a speed limit for overhead crane transfers such that a collision at the speed limit would not breach a naval SNF transportation cask. This requirement applies to the DTF naval cask handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.14 Requirement: The crane shall not be capable of moving above a speed limit for overhead crane transfers such that a collision at the speed limit would not breach a loaded sealed site-specific cask, loaded and sealed waste package, DOE HLW canister, standardized DOE SNF canister, naval SNF canister, or DPC. This requirement applies to the FHF main transfer room crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.15 Requirement: The crane shall not be capable of moving above a speed limit for overhead crane transfers such that a collision at the speed limit would not breach a loaded sealed waste package, standardized DOE SNF canister, DOE HLW canister, naval SNF canister, DOE MCO, loaded sealed site-specific cask, or DPC. This requirement applies to the CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.16 Requirement: The crane shall not be capable of exerting sufficient force during transfer to breach a cask as the result of attempts to overcome mechanical constraints. This requirement applies to the CHF cask handling crane and DTF cask handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.17 Requirement: The crane shall not be capable of exerting sufficient force to breach a cask, waste package, canister, or site-specific cask during transfer as the result of attempts to overcome mechanical constraints. This requirement applies to the FHF main transfer room crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.18 Requirement: In the event of a credible fire in an area where waste forms are present, the temperature of the crane that handles or transports SNF/HLW shall not reach a level that would make it drop its load. This requirement applies to the CHF cask handling crane, DTF cask handling crane, DTF naval cask handling crane, FHF entrance vestibule crane, FHF main transfer room crane, and CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.19 Requirement: A drop of a load from a crane that handles SNF/HLW due to a spurious signal caused by a fire shall have a probability of less than 1×10^{-4} over the life of the facility. This requirement applies to the CHF cask handling crane, DTF cask handling crane, DTF naval cask handling crane, FHF entrance vestibule crane, FHF main transfer room crane, and CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.20 Requirement: The crane lifting yokes shall be designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate sufficient seismic design margin to ensure that a "no drop" safety function is maintained for loading conditions associated with a BDBGM seismic event. This requirement applies to the cask preparation crane lifting yokes and the waste package crane lifting yokes. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.21 Requirement: The turntables shall be designed for stability and prevention of a tipover of any waste container on the table for loading conditions associated with a DBGM-2 seismic event. In addition, an analysis shall demonstrate that the turntable has sufficient seismic design margin to ensure that a "no tipover" safety function is maintained for loading conditions associated with a BDBGM seismic event. This requirement applies to the DTF turntables. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.22 Requirement: In the event of a credible fire in an area where waste forms are present, the temperature of machinery that handles or transports SNF/HLW shall not reach a level that would cause a drop of a cask while on a turntable. This requirement applies to the DTF turntables. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.23 Requirement: A tipover and breach of a cask while on a turntable that handles SNF/HLW due to uncontrolled movements produced by a loss of power or a spurious signal caused by a fire shall have a probability of less than 1×10^{-4} over the life of the facility. This requirement applies to the DTF turntables. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.24 Requirement: The cask pit protective covers shall be designed for loading conditions associated with a DBGM-1 seismic event and demonstrate sufficient seismic design margin to a "shielding integrity remains intact" safety function. This requirement applies to the CHF cask pit protective cover. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.25 Requirement: The waste package/MSC pit protective covers shall be designed for loading conditions associated with a DBGM-1 seismic event and demonstrate sufficient margin to a "no failure" safety function. This requirement applies to the CHF waste package/MSC pit protective covers. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.26 Requirement: The cask pit protective covers shall be sturdy enough to prevent a waste package or site-specific cask that is dropped on the pit cover from penetrating the pit cover and falling into the pit. This requirement applies to the CHF cask pit protective cover and CHF waste package/MSC pit protective covers. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.27 Requirement: Radiation exposure to workers due to inadvertent actuation of the pit protective covers shall be precluded such that this is not a Category 1 event. This requirement applies to the CHF cask pit protective cover and CHF waste package/MSC pit protective covers. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.28 Requirement: Crush pads shall limit the impact energy of a dropped canister, cask, or waste package to be less than or equal to the impact energy associated with a drop of a canister, cask, or waste package onto an unyielding surface from their maximum specified drop height for the canister, cask, or waste package. This requirement applies to the CHF pit crush pads. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.29 Requirement: Crush pads shall limit the impact energy of a dropped unsealed waste package to be less than or equal to the impact energy associated with a drop of an unsealed waste package onto an unyielding surface from the maximum specified drop height for the unsealed waste package. This requirement applies to the waste package crush pads. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.30 Requirement: Upon a loss of power, the trolley shall be designed to stop, retain its load, and enter a locked mode. Upon a restoration of power, the trolley shall stay in the locked mode until operator action is taken. This requirement applies to the DTF cask trolleys, pedestals, and hold-down devices; FHF cask trolleys, pedestals, and hold-down devices; DTF waste package trolleys, pedestals, and hold-down devices; CHF waste package trolleys, pedestals, and

hold-down devices; and FHF waste package trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.31 Requirement: The trolley system shall be designed for loading conditions associated with a DBGM-2 seismic event to maintain trolley stability and prevent waste container slapdown. In addition, an analysis shall demonstrate that the trolley system has sufficient seismic design margin to ensure that a "no slapdown" safety function is maintained for loading conditions associated with a BDBGM seismic event. This requirement applies to the DTF cask trolleys, pedestals, and hold-down devices and FHF cask trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.32 Requirement: The waste package trolleys shall be designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate sufficient margin to ensure that a "no tipover" safety function is maintained for loading conditions associated with a BDBGM seismic event. This requirement applies to the DTF waste package trolleys, pedestals, and hold-down devices; CHF waste package trolleys, pedestals, and hold-down devices; and FHF waste package trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.33 Requirement: The pedestals and hold-down devices shall be designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate sufficient seismic design margin to ensure that a "no tipover" safety function is maintained for loading conditions associated with a BDBGM seismic event. This requirement applies to the DTF cask trolleys, pedestals, and hold-down devices and FHF cask trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.34 Requirement: The pedestals and hold-down devices shall be designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate sufficient seismic design margin to ensure that a "no slapdown" safety function for loading conditions associated with a BDBGM seismic event. This requirement applies to the DTF waste package trolleys, pedestals, and hold-down devices; CHF waste package trolleys, pedestals, and hold-down devices; and FHF waste package trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.35 Requirement: The trolley shall be designed with an inherent speed limit such that a collision at the trolley speed limit would not cause the trolley to drop its load. This requirement

applies to the DTF cask trolleys, pedestals, and hold-down devices; FHF cask trolleys, pedestals, and hold-down devices; DTF waste package trolleys, pedestals, and hold-down devices; CHF waste package trolleys, pedestals, and hold-down devices; and FHF waste package trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.36 Requirement: Loaded transfer trolleys shall not derail or drop their load. This requirement applies to the DTF cask trolleys, pedestals, and hold-down devices; FHF cask trolleys, pedestals, and hold-down devices; DTF waste package trolleys, pedestals, and hold-down devices; CHF waste package trolleys, pedestals, and hold-down devices; and FHF waste package trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.37 Requirement: In the event of a credible fire in an area where waste forms are present, the temperature of the machinery that handles or transports SNF/HLW shall not reach a level that would make it drop its load. This requirement applies to the DTF cask trolleys, pedestals, and hold-down devices; FHF cask trolleys, pedestals, and hold-down devices; DTF waste package trolleys, pedestals, and hold-down devices; CHF waste package trolleys, pedestals, and hold-down devices, and FHF waste package trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.38 Requirement: A tipover and breach of a cask while on machinery that transports SNF/HLW due to uncontrolled movements produced by a loss of power or a spurious signal caused by a fire shall have a probability of less than 1×10^{-4} over the life of the facility. This requirement applies to the DTF cask trolleys, pedestals, and hold-down devices; FHF cask trolleys, pedestals, and hold-down devices; DTF waste package trolleys, pedestals, and hold-down devices; CHF waste package trolleys, pedestals, and hold-down devices; and FHF waste package trolleys, pedestals, and hold-down devices. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.39 Requirement: This crane shall not be capable of exerting sufficient force to breach a naval SNF transportation cask during transfer as the result of attempts to overcome mechanical constraints. This requirement applies to the DTF naval cask handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.40 Requirement: This crane shall not be capable of exerting sufficient force during transfer to breach a canister or waste package as the result of attempts to overcome mechanical constraints. This requirement applies to the CHF waste package and canister handling crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.1.41 Requirement: The crane shall not be capable of exerting sufficient force to breach a cask, waste package, or site-specific cask during transfer as the result of attempts to overcome mechanical constraints. This requirement applies to the FHF entrance vestibule crane. Supports Function 2.1.6.

Basis: This requirement is based on ensuring that the repository meets required preclosure safety objectives as stated in the *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512], Table A-II).

3.1.1.2 Environmental Requirements

Specific environmental requirements for the system have not been identified at this stage of the design. See Section 3.2.7 for environmental protection program requirements.

3.1.1.3 Mission-Critical Requirements

3.1.1.3.1 Requirement: The Cask/MSC/WP preparation system shall have an operational life of 50 years. Mechanical handling equipment shall satisfy this criterion directly or be maintainable or easily replaced over the system lifetime. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: The specification of a system operational lifetime is required to ensure that the system can fulfill system functions. [PDC 4.7.1.2]

3.1.1.3.2 Requirement: The design of the Cask/MSC/WP preparation system shall include features, attachments, tools, trolleys, seals, lifting and positioning equipment, and other appurtenances that ensure transportation casks are prepared for SNF/HLW transfer operations. Supports Function 2.1.1.

Performance Acceptance Criteria: The following cask preparation activities shall be accounted for in the design:

1. The cask preparation system shall be capable of unloading and processing various types and numbers of casks.

2. The cask preparation system shall be able to handle a throughput reflected in F&OR (Curry 2004 [DIRS 170557]), Appendix A, Table A-1. However, FHF does not have throughput requirements.

3. Equipment such as personnel barriers and impact limiters shall be removed, as required.

4. The cask shall be placed in a position consistent with transfer operations such that the cask at no time is lifted above its calculated no-breach drop height limits.

5. The inside of the cask shall be sampled for elevated pressure and gases that may indicate a hazardous condition, such as fission products and flammable or explosive gas mixtures.

6. The transportation cask shall be vented to atmospheric pressure. If combustible gases are present in the sample, the transportation cask must be purged until samples show a level at 25 percent of the lower explosive level.

7. The vented gas shall be controlled and dispositioned to meet regulatory requirements.

8. The system shall add all necessary attachments or equipment to the transportation cask as to facilitate a fit between the cask opening and the confinement part of the transfer area, as required.

9. The system shall provide interior access to the cask by performing activities, including, but not limited to, detorquing lid bolts and adding a lifting capability to the lid.

Basis: The specification of system capability is required to ensure that the system has the capability for cask preparation. [F&OR 1.1.2.1.1-1 through 1.1.2.1.1-6 and F&OR 1.1.2.1.1-8]

3.1.1.3.3 Requirement: The design of the Cask/MSC/WP preparation system shall include features, attachments, tools, trolleys, seals, lifting and positioning equipment, and other appurtenances that ensure site-specific casks and waste packages are prepared for SNF/HLW transfer operations. Supports Functions 2.1.2, 2.1.3, 2.1.7, and 2.1.8.

Performance Acceptance Criteria: The following site-specific cask and waste package preparation activities shall be accounted for in the design:

1. The system shall provide features to ensure site-specific casks and waste packages have the appropriate length, diameter, and internals consistent with the SNF/HLW to be transferred.

2. The system shall configure empty, loaded, unloaded site-specific casks, and waste packages with all equipment for lifting, moving, and confining.

3. The system shall place empty or unloaded site-specific casks and empty waste packages in a vertical orientation within acceptable limits of the transfer location while capable of ensuring confinement.

Basis: The specification of system capability is required to ensure that the system has the capability for site-specific cask and waste package preparation. [F&OR 1.1.2.1.2-1 through 1.1.2.1.2-3, F&OR 1.1.2.1.3-1 through 1.1.2.1.3-3]

3.1.1.3.4 Requirement: The design of the Cask/MSC/WP preparation system shall include features, attachments, tools, trolleys, seals, lifting and positioning equipment, survey, and other appurtenances that ensure casks are restored for return to the National Transportation System. Unloaded site-specific casks are ready for reuse. Supports Functions 2.1.4 and 2.1.9.

Performance Acceptance Criteria: The system shall isolate the empty transportation cask to conduct the necessary surveys to allow redeployment.

1. The system shall have the capability to survey the exterior of the cask to ensure that smearable contamination is within acceptable limits for redeployment. (For acceptable radiation limits, see Section 3.1.2.3.)

2. The system shall have the capability to replace and close the cask lid in accordance with its operating procedures prior to redeployment.

Basis: The specification of system capability is required to ensure that the system has the capability for cask redeployment. [F&OR 1.1.5.1-1,1.1.1.5-3 and 1.1.1.5-4]

3.1.1.4 General Requirements

3.1.1.4.1 Requirement: Equipment designs with proven operational performance shall be used where possible. Similarly, existing technology, where available and suitable from other nuclear establishments, shall be used in the design of facilities and systems in preference to untried novel technology. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1.2]

3.1.1.4.2 Requirement: Mechanical handling systems shall provide overload limit sensing, collision avoidance, and alarming capabilities to automatically stop handling operations and warn operators of unsafe conditions only for specific SSCs as required by the preclosure safety analyses or other operational requirements. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1.2]

3.1.1.4.3 Requirement: The system shall be designed to provide redundant stations for each cell to allow human oversight and the control of material handling operations. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9

Basis: This requirement meets the need to control all aspects of the SNF/HLW transfer [F&OR 1.1.6-3]

3.1.1.4.4 Requirement: The system shall be designed such that lifting or handling equipment will not contact or damage the waste package surface during normal operations. Supports Function 2.1.2.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1.2]

3.1.2 Subsystem and Major Components

3.1.2.1 Requirement: Bridge cranes shall be designed per CMAA 70-2000 (CMAA 2000 [DIRS 153997]) or CMAA 74-2000 (CMAA 2000 [DIRS 154319]). ASME NOG-1 (ASME 2002 [DIRS 158891]) Type I shall be applied to cranes that are ITS and perform critical lifts. ASME NOG-1 Type II shall be applied to cranes that do not handle a critical load, but must remain in place during a seismic event. Cranes requiring single-failure proof features shall also

follow NUREG-0554 (NRC 1979 [DIRS 103347]) guidelines, which may be addressed by specific requirements in ASME NOG-1 (ASME 2002 [DIRS 158891]). Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1]

3.1.2.2 Requirement: The cask restoration subsystem shall provide the capability to inspect transportation casks, including Naval Nuclear Propulsion Program (NNPP) transportation casks, to assess any damage using appropriate instrumentation and facilities. Inspection of NNPP transportation casks shall be performed in accordance with instructions provided by NNPP. Supports Function 2.1.4.

Basis: To meet U.S. Department of Transportation requirements, any damage to a transportation cask must be evaluated before it can be released for subsequent shipments. NNPP transportation casks must be inspected per instructions provided by NNPP. [F&OR 1.1.4.1.3-1 and 1.1.1.5-7 and 1.1.1.5-5]

Comments: Detailed inspection requirements to redeploy casks are not yet developed. Appropriate revision of the SDD will incorporate new information when it is made available.

3.1.2.3 Requirement: The cask restoration subsystem shall perform radiation surveys of unloaded transportation casks, including NNPP transportation casks. Supports Function 2.1.4.

Basis: To meet U.S. Department of Transportation requirements, transportation casks must be evaluated before they can be released for subsequent shipments. [F&OR 1.1.1.5-2]

Performance Acceptance Criteria:

1. The system shall provide certainty of the external radiation levels after closing the empty commercial or DOE shipping cask and returning for redeployment. Radiation levels shall be ≤ 200 mrem/hr surface and ≤ 10 mrem/hr at 2 meters (Curry 2004 [DIRS 170557], Section 1.1.1.5-2).

2. Surface contamination levels on the exterior of the cask shall be < 2200 dpm per 100 cm^2 beta/gamma or 220 dpm alpha prior to redeployment (Curry 2004 [DIRS 170557], Section 1.1.1.5-3).

3. Any naval cask leaving the repository shall be prepared for transportation in accordance with 49 CFR Chapter I, Subchapter C [DIRS 148892] and with the operating procedures provided by NNPP (Curry 2004 [DIRS 170557], Section 1.1.1.5-7).

4. In addition to the requirements of 49 CFR Part 173 [DIRS 126145], the exterior and interior of a naval cask must not have non-fixed contamination in excess of 1,000 dpm/100 cm^2 beta/gamma and 110 dpm/100 cm^2 alpha (per the NNPP site representative). If decontamination is required, the equipment and methods shall be approved by NNPP prior to decontamination work (Curry 2004 [DIRS 170557], Section 1.1.1.5-7).

3.1.3 Boundaries and Interfaces

No requirements for system boundaries and interfaces have been identified. As the design progresses, these requirements will be developed and added to this SDD.

3.1.4 Codes, Standards, and Regulations

In addition to the codes, standards, and regulations that are referenced in the individual requirements of Section 3, a comprehensive list of these documents is found in Section 4.7.1.1 of the PDC (BSC 2004 [DIRS 171599]), which lists the codes, standards and regulations applicable to the mechanical handling system.

3.1.5 Operability

This section will provide the operability requirements for the system. This will include technical specification requirements, if applicable, and other operating requirements from modes and conditions such as startup, normal operations, shutdown, emergency operations, and other system operations. Operability functional requirements will be prepared after operations input to design is provided.

3.2 SPECIAL REQUIREMENTS AND BASES

All scenarios relating to the Cask/MSC/WP preparation system presented in the *Preliminary Hazards Analysis for License Application Study* (BSC 2004 [DIRS 167313]) have been screened for applicability. Existing design requirements have been found to capture all necessary requirements for mitigation control of applicable scenarios.

3.2.1 Radiation and Other Hazards

3.2.1.1 Requirement: Mechanical handling system components shall operate satisfactorily in the radiation environment to which they are exposed and withstand the cumulative effect of radiation exposure anticipated over their design life. Where the use of radiation-resistant components is not feasible, such components shall be easily replaceable. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1.2]

3.2.2 As Low As Is Reasonably Achievable (ALARA)

3.2.2.1 Requirement: The system design shall include features that will ensure occupational personnel exposure remains within the regulatory limits. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9

Basis: This requirement is based on compliance with 10 CFR Part 20 [DIRS 167538] limits for occupational exposure. [PDC 4.9.1.2] (BSC 2004 [DIRS 171599])

3.2.2.2 Requirement: The system design shall incorporate additional features to meet the ALARA individual and collective dose design goals for occupational workers for normal and Category 1 event sequences. The ALARA design goal for individual radiation worker doses is to

minimize the number of individuals that have the potential of receiving more the 500 mrem/year total effective dose equivalent. The design goal for collective doses is to maintain the average annual dose for workers ALARA. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on compliance with project ALARA goals. [PDC 4.9.3.3]

3.2.3 Nuclear Criticality Safety

3.2.3.1 Requirement: The system shall be designed to minimize the potential for a criticality in the surface facility by limiting the amount of moderator that may be present in any area where radioactive waste is being handled. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.5, 2.1.7, and 2.1.8.

Basis: This requirement supports nuclear criticality safety. [PDC 4.9.2.2.3]

3.2.4 Industrial Hazards

The Cask/MSC/WP preparation system shall include environmental, safety, and health requirements related to industrial safety. Included are considerations for protection from heavy moving equipment and hazardous materials.

When detailed operational steps are developed, the industrial hazards will be identified, and applicable design criteria and codes and standards will be applied.

For the Cask/MSC/WP preparation system, the following industrial hazards shall be prevented or mitigated:

- Electrical
  - Arcing
  - Burns
  - Fire
  - Shock
  - Shorting (faulting)
  - Static electricity
- Environmental impacts
  - Regulated materials/hazardous substances
  - Waste management
- Mechanical
  - Fire
  - Hydraulic pressure
  - Impacts/blunt force
  - Implosion from vacuum
  - Pneumatic pressure

  - Rotating equipment
  - Vibration

- Personnel

  - Confined space
  - Falls
  - Lifting
  - Pinch points
  - Sharp edges/points
  - Slips/trips
  - Dust/chemicals/physical agents/radon

- Testing/operations/construction/maintenance

  - Access/egress
  - Cutting
  - Elevated work
  - Falling objects
  - Fire
  - Hoisting and rigging
  - Mobile/heavy equipment

3.2.5 Operating Environment and Natural Phenomena

3.2.5.1 Requirement: Mechanical handling system components that operate indoors shall be designed to withstand and operate under the environmental conditions to which they will be exposed. These conditions are defined in Tables 4.8.2-1, 4.8.2-2, and 4.8.2-3 of the PDC (BSC 2004 [DIRS 171599]) for the areas in which the system components are located. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1.2]

3.2.6 Human Interface Requirements

3.2.6.1 Requirement: The system shall provide real time monitoring, control, and data acquisition. Operator graphics, which are used for control and monitoring, shall be designed in accordance with the guidelines contained in the standards listed in IEEE Standard 1289-1998, *IEEE Guide for the Application of Human Factors Engineering in the Design of Computer-Based Monitoring and Control Displays for Nuclear Power Generating Stations* (IEEE 1998 [DIRS 164225]); ISA S5.5-1985, *Graphic Symbols for Process Displays* (ISA 1986 [DIRS 164283]); ANSI/IEEE Standard 260.1-1993, *American National Standard Letter Symbols for Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units)* (ANSI/IEEE 1993 [DIRS 164235]); and the applicable sections of NUREG-0700, *Guidelines for Control Room Design Reviews* (NRC 1996 [DIRS 146094]). Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on applicable codes and standards. [PDC 4.6.1.2.1]

3.2.6.2 Requirement: The system shall provide alarms, operator messages, and status indications. The design of the presentation of alarms, messages, and indications shall be in accordance with guidelines contained in IEEE Standard 1289-1998 (IEEE 1998 [DIRS 164225]); ANSI/ISA 18.1-1992, *Annunciator Sequences and Specifications* (ANSI/ISA 2003 [DIRS 164264]), as applied in Appendix A.5; and applicable sections of NUREG-0700 (NRC 1996 [DIRS 146094]). Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on applicable codes and standards. [PDC 4.6.1.2.2]

3.2.6.3 Requirement: Control capabilities shall be provided locally where dictated by the operation. The design of local control consoles shall be in accordance with the guidelines contained in IEEE Standard 1023-1988 (IEEE 1998 [DIRS 124974]), IEEE Standard 1289-1998 (IEEE 1998 [DIRS 164225]), NEMA ICS 6-1993 (R2001) (NEMA 2001 [DIRS 164222]), applicable sections of NUREG-0700 (NRC 1996 [DIRS 146094]), and considering Occupational Safety and Health Administration ergonomic factor guidelines. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on applicable codes and standards. [PDC 4.6.1.3.3]

3.2.7 Specific Commitments

Some specific environmental requirements for the system have been identified at this stage of the design. Environmental requirements for addressing land disturbance from system construction and operation may be needed and will be added to the SDD when these requirements are developed.

3.2.7.1 Requirement: The repository shall be designed with pollution prevention systems to control air emissions and effluents, minimize water use, and reduce or eliminate discharges to the environment.

Basis: DOE O 450.1, *Environmental Protection Program* (DOE 2003 [DIRS 161567]), establishes DOE policy to conduct its operations in an environmentally safe and sound manner and to perform its activities in compliance with applicable environmental protection requirements. The design shall comply with applicable environmental requirements set forth by federal and state regulations, executive orders, and DOE directives and requirements derived from environmental permits and corresponding permit conditions. [PDC 4.1.1.9]

Comments: Some examples are that system components are designed to minimize possible leakage of lubricants or fluids and that components that can become radioactively contaminated shall be manufactured with materials that will minimize the possibility of generating mixed waste when decontaminated.

3.2.7.2 Requirement: The repository shall be designed with a goal to reduce energy and water consumption while increasing the use of clean energy sources.

Basis: To meet or exceed the goals of the laws, executive orders, and federal regulations for energy efficiency, use of renewable energy, and water conservation at DOE facilities. This requirement pledges compliance with 10 CFR Part 435, Energy: Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for

Federal Buildings [DIRS 156267], that provides the minimum standards for energy efficiency goals in the design of new federal buildings. 10 CFR Part 435 provides design requirements for building envelopes, electrical distribution systems, and equipment for electric power, lighting, HVAC, service water heating, and energy management. This is also in conformance with DOE O 430.2A, *Departmental Energy and Utilities Management* (DOE 2002 [DIRS 158913]), and with 64 FR 30851 [DIRS 104026], Executive Order 13123, that provides the goals for the reduction of greenhouse gas emissions attributed to the energy use of federal buildings. [PDC 4.1.1.1]

3.3 ENGINEERING DISCIPLINARY REQUIREMENTS AND BASES

3.3.1 Civil and Structural

There are no civil and structural requirements for the system identified at this stage of the design.

3.3.2 Mechanical and Materials

The design methods and analytical techniques include loading conditions and material selections for the ITS SSCs. Well established engineering methods, analytical techniques, defining configurations and functions, and selecting materials of construction are used to evaluate and design ITS SSCs. The designs include normal conditions and those associated with Category 1 and Category 2 event sequences and consequences. The ITS SSCs are designed to meet or exceed design code provisions so that each will safely perform the safety analysis credited design function to ensure compliance with 10 CFR 63 [DIRS 173164]. The design methods and analytical techniques include loading conditions and material selections for the ITS SSCs.

No specific HVAC requirements for the system have been identified at this stage of the design.

3.3.3 Chemical and Processes

There are no chemical and process requirements for the system identified at this stage of the design.

3.3.4 Electrical Power

Electrical power requirements for this system will be identified as the design develops.

3.3.5 Instrumentation and Control

See Requirements 3.2.6.1, 3.2.6.2, and 3.2.6.3. Additional instrumentation and control requirements may be developed as the design progresses and will be added to the SDD.

3.3.6 Computer Hardware and Software

There are no computer hardware and software requirements for the system identified at this stage of the design. Computer and software requirements will be developed as the design progresses and will be added to the SDD.

3.3.7 Fire Protection

The fire protection system is explained and the requirements are identified in the fire protection documentation.

The Cask/MSC/WP preparation system requires fire protection systems that are governed by the fire protection design criteria and codes and standards given in Section 4.8.1.1 of the PDC. As more detailed design becomes available, the fire protection system and its interface with the Cask/MSC/WP preparation system will be defined.

Fire hazards are identified for the DTF, CHF, and FHF in the following fire hazard analysis documentation:

- Dry Transfer Facility: BSC 2005. *Dry Transfer Facility No. 1 - Fire Hazard Analysis.* (BSC 2005 [DIRS 172805]). Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

- Canister Handling Facility: BSC 2005. *Canister Handling Facility Fire Hazard Analysis* (BSC 2005 [DIRS 168814]. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

- Fuel Handling Facility: BSC 2004. *Fuel Handling Facility Fire Hazard Analysis.* (BSC 2004 [DIRS 172147]). Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.8.1.1]

3.4 TESTING AND MAINTENANCE REQUIREMENTS AND BASES

3.4.1 Testability

3.4.1.1 Requirement: Mechanical handling systems shall include provisions for the inspection, testing, and maintenance of system equipment in accordance with applicable DOE and industry standards and Occupational Safety and Health Administration requirements. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1.2]

3.4.2 Safety-Required Surveillances

No system requirements have been developed for this section at this time.

3.4.3 Non-Safety Inspections and Testing

No system requirements have been developed for this section at this time.

3.4.4 Maintenance

3.4.4.1 Requirement: Recovery features shall be provided for cranes, trolleys, and similar equipment located in high or very high radiation areas to retrieve failed equipment to a shielded maintenance area. Alternatives, such as the use of temporary shielding to permit in-place maintenance, may be employed in specific situations provided that ALARA criteria are met. Supports Function 2.1.6.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1.2]

3.5 OTHER REQUIREMENTS AND BASES

3.5.1 Security and Special Nuclear Materials Protection

Security and safeguards requirements for the system will be established when the vulnerability assessment is performed and the physical protection plan is prepared.

3.5.2 Special Installation Requirements

There are no special installation requirements for the system that have been established. Vendor instructions for purchased equipment may call out special installation requirements and these will be added to the SDD, as needed.

3.5.3 Reliability, Availability, and Preferred Failure Modes

See Section 3.1.1.1 for specific failure mode requirements. There are no other unique requirements concerning reliability, availability, or preferred failure modes that are applicable to the system at this time.

3.5.4 Quality Assurance

The minimum quality assurance requirements for the Office of Civilian Radioactive Waste Management program are established in the *Quality Assurance Requirements and Description* (DOE 2004 [DIRS 171539]). These include quality assurance requirements related to procurement, fabrication, construction, production, handling, packaging, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, modifications, and decontamination. No quality assurance requirements specific to the Cask/MSC/WP preparation system have been identified at this stage of the design.

3.5.4.1 Requirement: The design of the system shall be in accordance with project design control procedures and Section 3 of the *Quality Assurance Requirements and Description* (DOE 2004 [DIRS 171539]).

Basis: This requirement is based upon compliance with Section 3 of the *Quality Assurance Requirements and Description* (DOE 2004 [DIRS 171539]).

3.5.5 Miscellaneous Requirements

3.5.5.1 Requirement: Mechanical handling systems design shall include provisions for decontamination and decommissioning. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1]

3.5.5.2 Requirement: Equipment, tools, and fixtures in areas with the potential for contamination shall have an appropriate surface finish and geometry to facilitate

decontamination and minimize the accumulation of contamination. Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1]

3.5.5.3 Requirement: The mechanical handling system shall be designed to meet the seismic criteria in Section 6.1.3 of the PDC (BSC 2004 [DIRS 171599]). Supports Functions 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.1.8, and 2.1.9.

Basis: This requirement is based on good engineering practice. [PDC 6.1.3]

3.5.5.4 Requirement: Overhead and gantry cranes and cask transporters shall not lift casks, canisters, or waste packages containing SNF/HLW higher than their design basis drop height above an unyielding surface. Where necessary to lift beyond the design basis drop height, impact absorbers or crush pads shall be used in accordance with *Nuclear Safety Design Bases for License Application* (BSC 2005 [DIRS 171512]). Supports Functions 2.1.1, 2.1.5, 2.1.6, and 2.1.8.

Basis: This requirement is based on good engineering practice. [PDC 4.7.1]

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4. SYSTEM DESCRIPTION

4.1 CONFIGURATION INFORMATION

4.1.1 Description of System, Subsystems, and Major Components

The Cask/MSC/WP preparation system consists of SSCs necessary to receive transportation casks, waste packages, DPCs, and site-specific casks, and prepare them for waste transfer operations. The system also restores unloaded transportation casks and loaded or unloaded site-specific casks for leaving the waste processing facilities or a loaded transportation cask for moving to the remediation system. The SSCs described in this section are located in the DTF, CHF, and FHF.

4.1.1.1 Dry Transfer Facility

4.1.1.1.1 Cask Preparation Subsystem Description

The cask preparation subsystem prepares casks for waste transfer operations within the DTF. Loaded transportation casks and empty site-specific casks enter the DTF through the cask and MSC entrance vestibule (Room 1079) delivered on SRTCs to the cask and MSC SRTC receipt area (Room 1077). Loaded and unloaded site-specific casks are delivered by the site-specific cask transporter through Room 1079 to Room 1077. An initial inspection and survey is performed using the mobile elevating platform. Loaded naval casks are received in the waste package and naval cask entrance vestibule (Room 1060) delivered on SRTCs to the waste package/naval cask SRTC receipt area (Room 1058).

The following discussion is typical for all transportation casks except those containing naval canisters. The preparation of transportation casks containing naval canisters is discussed later in this section.

The transportation cask impact limiters, personnel barrier, and tie-downs are removed, if applicable, using the 25-ton material handling crane and secured on a pallet. Radiological surveys will be performed as required. Following the survey, the impact limiters and personnel barriers are moved using a forklift to Room 1079 for storage.

The cask trolley is prepared in the cask and MSC to trolley transfer room (Room 1076) using the cask pedestal gantry crane and appropriate cask trolley pedestal. The necessary cask trolley pedestals are stored on the cask trolley pedestal stands located in Room 1076 and the transportation cask pedestal and lifting yoke storage area (Room 1078). Additional pedestals may be stored in other locations, such as a warehouse outside the cask preparation subsystem.

The 200-ton cask handling crane is used to upend and move the transportation cask or site-specific cask to the cask trolley. After the transportation cask or site-specific cask is mounted on the cask trolley, the cask trolley is moved to various locations in the DTF where cask preparation operations are performed. The cask trolley rides on a system of rails. Turntables are used to align the cask trolley to the proper set of rails as it moves through the DTF. There are three turntables within the DTF. Two of the turntables are located in the

Cask/MSC turntable room (Room 1073) and cask and MSC docking room (Room 1069). The third turntable is part of the remediation system.

The transportation cask/site-specific cask preparation activities are performed in the cask preparation room (Room 1074). The unbolting and inspection station and docking ring positioning and installation station are in Room 1074. The loaded transportation cask or loaded site-specific cask preparation activities include gas sampling for loaded cask/site-specific casks, unbolting cask/site-specific cask lids, and installing docking rings. Gas sampling is performed at the unbolting and inspection station. If the gas sampling results exceed established limits, the loaded transportation cask or loaded site-specific cask will be transferred to the remediation system. If the transportation cask design utilizes an outer lid, the cask trolley is moved under the unbolting and inspection station for removal of the outer lid bolts (sufficient bolts are left engaged to prevent the lid from coming off during movement of the cask). If the cask also has an inner lid, the cask trolley is repositioned under the unbolting and inspection station where the outer lid bolts are removed. The cask trolley is moved to the docking ring positioning and installation station for removal of the outer lid. The cask trolley is returned to the unbolting and inspection station where the cask internal pressure is normalized and the inner lid bolts are removed, except for those bolts required to keep the lid on.

After the appropriate lid is prepared, the cask trolley is then moved and positioned under the docking ring positioning and installation station and the cask docking ring is installed. Empty/unloaded site-specific casks that are to be loaded follow the same cask/site-specific cask preparation activities.

Following installation of the cask docking ring, the cask trolley is moved to the cask and MSC docking room (Room 1069). The transportation cask/site-specific cask is positioned under one of the two cask docking stations and control is passed to the SNF/HLW transfer system, which performs the docking and unloading process.

Transportation casks loaded with DPCs are received and processed through the cask and MSC entrance vestibule (Room 1079), cask and MSC SRTC receipt area (Room 1077), cask and MSC to trolley transfer room (Room 1076), and Cask/MSC turntable room (Room 1073). The cask trolley, along with the transportation cask, is moved from Room 1073 through the cask preparation room (Room 1074) to the DPC preparation/cask dry remediation room (Room 1100), where preparations for DPC transfer are initiated using equipment located in the DPC preparation station (Room 2057). The cask is vented and purged. The outer lid bolts, outer lid, and inner lid bolts, as appropriate, are loosened and most are removed and stored in Room 2057, and a docking ring is attached to the cask. The prepared cask is moved to the DPC docking room (Room 1101) and positioned for subsequent transfer operations.

Naval casks arrive at the repository and are to remain free of radiological contamination; therefore, they are handled through the waste package and naval cask process line. Loaded naval casks enter the DTF on SRTCs through the waste package and naval cask entrance vestibule (Room 1060) to the waste package/naval cask SRTC receipt area (Room 1058). The impact limiters and personnel barrier, if applicable, are removed using the 50-ton waste package handling crane, secured to a pallet, and moved to staging stands by forklift. The cask, impact limiters, and personnel barrier are surveyed for radiological contamination.

The naval cask trolley pedestal is installed on the waste package trolley in the waste package/naval to trolley transfer room (Room 1057). The 200-ton naval cask handling crane is used to upend and move the naval cask into Room 1057. When the naval cask is secured to the waste package trolley, the cask is moved to the waste package/naval cask preparation room (Room 1053). The naval cask preparation activities include gas sampling, normalizing internal cask pressure, detorquing, and removing the cask lid bolts. Sufficient bolts are left engaged so the lid will not come off during cask transfer. Following preparation, the cask trolley is moved to the waste package loading (naval canister)/docking ring removal cell (Room 1051) and positioned for subsequent transfer operations. The SNF/HLW transfer system performs the waste transfer.

The cask preparation subsystem consists of areas in the DTF on Level 0 ft, Level 32 ft, and upper regions of the building above the 66 ft level. The crane areas include provisions for recovery and maintenance. The details of the rooms used by the cask preparation subsystem are shown on drawings listed in Appendix B.

4.1.1.1.2 Waste Package Preparation Subsystem Description

The waste package preparation subsystem prepares empty waste packages for waste transfer operations within the DTF. Empty waste packages enter the DTF through the waste package and naval cask entrance vestibule (Room 1060) and are delivered on SRTCs to the waste package/naval cask SRTC receipt area (Room 1058). Empty waste packages are also delivered on a second rail line to the waste package SRTC receipt area (Room 1059). The protective waste package access cover is removed and an initial inspection is performed using the mobile elevating platform. The waste package middle and outer lids are removed from the SRTC and moved to the waste package closure support room (Room 2024).

The waste package trolley is prepared in the waste package/naval to trolley transfer room (Room 1057) with the jib crane and appropriate waste package trolley pedestal. The waste package trolley pedestals are stored on waste package trolley pedestal stands located in Room 1057. The 50-ton waste package handling crane is used to move the waste package from the SRTC to the prepared waste package trolley in Room 1057. The waste package trolley is moved to the waste package preparation room (Room 1056) or waste package/naval cask preparation room (Room 1053), depending on the rail line. Within the preparation room, the waste package docking ring is installed. The waste package is moved to either of the waste package docking cells (Rooms 1052 or 1055) for docking and loading by the SNF/HLW transfer system. For loading from naval casks positioned in Room 1051, the waste package is moved directly to the waste package loading/docking ring removal cell (Room 1054) for loading by the SNF/HLW transfer system. Docking rings are not used for naval canister transfer.

Following waste package loading operations performed by the SNF/HLW transfer system, the waste package trolley is located in either Room 1051 or 1054, and the docking ring is returned to the waste package preparation subsystem in the naval transfer/docking ring removal cell (Room 2043). The waste package Docking Ring is decontaminated, placed on a (clean) docking ring pallet and moved to the docking ring staging room (Room 2049).

The waste package preparation subsystem consists of areas of the DTF on Level 0 ft, Level 32 ft, and upper regions of the building for cranes up to Level 125 ft. The crane areas include provisions for recovery and maintenance. The details of the rooms used by the waste package preparation subsystem are shown on the drawings listed in Appendix B.

4.1.1.1.3 Cask Restoration Subsystem Description

The cask restoration subsystem prepares casks for export following waste transfer operations. Unloaded transportation casks (except naval transportation casks) and loaded or unloaded site-specific casks are returned to the Cask/MSC/WP preparation system from the SNF/HLW transfer system following waste transfer operations. Unloaded transportation casks and loaded or unloaded site-specific casks are moved from the cask and MSC docking room (Room 1069) or the DPC docking room (Room 1101). The cask trolley is moved to the cask restoration room (Room 1072).

Within Room 1072 and the cask docking ring installation room (Room 2051) at the cask restoration station, the docking ring is removed, decontaminated, and sent back to the cask preparation subsystem. The lid is fastened and checked for tightness. The outer lid is installed (depending on cask design). For a loaded site-specific cask, the cask cavity is inerted. An external radiological survey is performed on the cask, trolley, and pedestal, and the cask trolley is moved to the cask and MSC to trolley transfer room (Room 1076).

From Room 1076, the unloaded transportation cask is lifted with the 200-ton cask handling crane, placed on the SRTC in the cask and MSC SRTC receipt area (Room 1077), and down ended back to a horizontal position. The cask tie downs are installed, as necessary. The impact limiters and personnel barrier are installed, if necessary. A radiological survey and final inspection are performed, then the unloaded transportation cask is moved through the cask and MSC entrance vestibule (Room 1079) to the cask receipt and return system on the SRTC. The cask transporter moves the loaded or unloaded site-specific cask to the SNF aging system.

Unloaded naval casks are returned to the Cask/MSC/WP preparation system by the SNF/HLW transfer system following waste transfer operations. The cask lid is set in place and the unloaded naval cask and waste package trolley moves from the waste package loading (naval canister)/docking ring removal cell (Room 1051) to the waste package/naval cask preparation room (Room 1053). The cask lid bolts are installed and a radiological survey is performed. The naval cask is then moved from the waste package/naval to the trolley transfer room (Room 1057), lifted by the 200-ton naval cask handling crane, placed on the SRTC, and down ended to the horizontal position in the waste package/naval cask SRTC receipt area (Room 1058).

The naval cask tie downs are installed, as necessary, and a radiological survey is performed. The impact limiters and personnel barrier are installed, if necessary. A second radiological survey and final inspection are performed. The unloaded naval cask on the SRTC is moved through the waste package and naval cask entrance vestibule (Room 1060) to the cask receipt and return system.

The cask restoration subsystem consists of areas of the DTF on Level 0 ft, Level 32 ft, and upper regions of the building for cranes above the 66 ft level. The crane areas include provisions for

maintenance. The details of the rooms used by the cask restoration subsystem are shown on the drawings listed in Appendix B.

4.1.1.1.4 Major Components

Equipment and component descriptions are listed by each subsystem to which they are assigned. The equipment may be used by more than one subsystem, but will be described only once.

4.1.1.1.4.1 Cask Preparation Subsystem Major Components

- **200-ton Cask Handling Crane and 200-Ton Naval Cask Handling Crane**–There is a 200-ton cask handling crane in the cask and MSC SRTC receipt area (Room 1077) and a 200-ton naval cask handling crane in the waste package/naval cask SRTC receipt area (Room 1058). These cranes handle transportation casks, site-specific casks, and naval transportation casks, respectively. The cranes are virtually identical in appearance and design parameters. Each crane has a top running, double girder electric bridge, trolley, and hoisting unit. The bridge and trolley each have two independent drives consisting of a motor, brake, and gear reducer. The drives operate simultaneously when moving the bridge or trolley.

  Both cranes move casks from SRTCs to trolleys. Both cranes also perform the same function in reverse, moving respective unloaded casks from trolleys back onto SRTCs or a site-specific transporter prior to leaving the DTF.

  The cranes are classified as ITS. Specific trolley structures, bridge structures, hoisting drive trains, and load gripping devices are ITS components. The drop rate for the cask handling crane and naval cask handling crane is less than or equal to 1×10^{-5} drops/transfer regardless of cause (Section 3.1.1.1.1). The cask handling crane and naval cask handling crane and their rigging is designed for loading conditions associated with a DBGM-2 seismic event and to ensure a "no drop" safety function for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.11). The crane speed is limited to prevent a cask breach following a collision (Sections 3.1.1.1.12 and 3.1.1.1.13). The crane shall not be capable of exerting sufficient force during transfer to breach a cask while attempting to overcome mechanical constraints (Sections 3.1.1.1.16 and 3.1.1.1.39).

  The rated capacity of the crane exceeds the combined weight of the heaviest transportation cask and associated lifting devices, with design margins specified in ASME NOG-1-2002 (ASME 2002 [DIRS 158891]) and CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

  The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

  Crane interfaces include those between the crane and runways supported by building walls and the crane and the electrical power system, which supplies power to the electric bridge, trolley, hoist motor, and brakes. On loss of power, the crane is designed to stop,

retain the load, and enter a locked mode. Upon restoration of power, the crane stays in the locked mode until operator action is taken (Section 3.1.1.1.2). The electrical system also supplies uninterruptible power to the crane's instrumentation and control systems. If the instrumentation and control systems lose their power, these systems are designed to fail-safe and to give accurate indication upon power restoration. A drop of a load from the cask handling crane and naval cask handling crane due to a spurious signal caused by a fire is less than 1×10^{-4} over the life of the facility. In the event of a credible fire, the temperature of the cask handling crane and naval cask handling crane will not reach a level that would make it drop its load (Sections 3.1.1.1.18 and 3.1.1.1.19).

Operators control the 200-ton cask handling cranes by pendant control, located in areas with the crane to provide the operator with an unobstructed view of handling operations.

Engineered features prevent the cranes or their loads from colliding with structures or major SSCs. These engineered features include mechanical stops and bumpers, as well as limit switches and interlocks in the crane control circuitry. Limit switches and interlocks stop the cranes or hoisting before safety limits are reached. This includes limiting the height that the load can be lifted to prevent exceeding the drop height (Sections 3.1.1.1.4, 3.1.1.1.6, and 3.1.1.1.7). These interlocks will be entered into the crane software to match the cask configuration to be lifted and administratively controlled. Interlocks also prevent the cranes from lifting loads weighing more than their load capacity. Other interlocks prevent over travel (in forward and reverse), collisions with other cranes, load drops, and load tilting potentially resulting in damage to lift points or the lifting yoke.

The 200-ton cask handling crane and 200-ton naval cask handling crane do not directly contact transportation casks or other equipment that may be contaminated and the cranes are located in an area where no contamination is expected. Therefore, there are no design or manufacturing requirements to limit the retention of contamination or to facilitate decontamination. Radiation detection systems are not installed on the crane.

Work platforms and other accesses are provided in the DTF for availability to control, inspect, maintain, and repair the crane, as required.

- **25-ton Material Handling Crane**–The 25-ton material handling crane in the cask and MSC SRTC receipt area (Room 1077) is used to lift lighter loads associated with cask preparation and restoration. These loads include the transportation cask impact limiters and personnel barriers, as necessary. The 25-ton material handling crane also is used in the maintenance of the 200-ton cask handling crane.

  The 25-ton material handling crane is non-ITS. However, the crane design ensures that a seismic event does not cause the crane to overturn, derail, lose any main structural components, or drop a load that could have an adverse impact on a transportation cask that contains SNF or HLW. Additionally, loads carried by the crane and the lift heights and load paths are restricted to ensure that the crane does not drop a load that could breach a loaded transportation cask or site-specific cask.

The 25-ton material handling crane is a top running, double girder bridge crane, with electric bridge, trolley, and hoist drives. Two motors drive the bridge, each with a self-contained gear reducer on each side of the bridge. A single motor drives the trolley with a self-contained gear reducer.

The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

The crane interfaces with runways, building walls that support it, and the electrical system, which provides power for the electric bridge, trolley, hoist motors, and brakes. The crane does not directly contact transportation casks or other equipment that may be contaminated and is located in an area where no airborne contamination is expected. Therefore, there are no design or manufacturing requirements for the crane to limit the retention of contamination or facilitate decontamination.

Pendant controls located on the deck of the cask receipt area operate the 25-ton material handling crane.

The rated capacity of the crane exceeds the weight of the heaviest anticipated load with design margins specified in ASME NOG-1-2002 (ASME 2002 [DIRS 158891]) and CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

Work platforms and other access are provided in the DTF for availability to control, inspect, maintain, and repair the crane, as required.

- **Cask Lifting Yoke**–The cask lifting yoke is used to upend transportation casks or empty site-specific casks or naval casks on SRTCs from a horizontal to vertical position. The yoke is also used to lift and transfer transportation casks, site-specific casks, or naval casks to cask trolleys. The lifting yoke is classified as ITS. The drop rate for the cask lifting yoke is less than or equal to 1×10^{-5} drops/transfer (Section 3.1.1.1.1). The cask lifting yoke is designed for loading conditions associated with a DBGM-2 seismic event and to ensure that a "no drop" safety function is maintained for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.20).

  The lifting yoke uses interchangeable arms to accommodate the different type casks and site-specific casks. Two arms on the cask lifting yoke interface with the cask trunnions. These motor-driven beam-supported arms are locked to the trunnion after the load is engaged. In addition, the lifting yoke interfaces with the cask handling crane (via the control and console) on the crane, trunnion supports, and electrical power system.

  The rated capacity of the lifting yoke exceeds the weight of the heaviest anticipated loads with design margins specified in ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]).

  Interfaces between the lifting yoke and other facility systems include the basic structural connection between the yoke beam and 200-ton cask handling crane pulley block. There is also a structural interface between the lifting yoke lifting arms and the transportation

cask and site-specific cask trunnions. There are electrical and control interfaces between the lifting arm motor drive and normal electrical supply system.

The cask lifting yoke comes into direct contact with the transportation cask and site-specific casks that may be contaminated. Therefore, there are design or manufacturing requirements to limit the retention of contamination or facilitate decontamination (Section 3.5.5.2).

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards. The lifting yoke is maintained and periodically tested in accordance with the requirements of ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]) and ASME B30.20-1993 (ASME 2003 [DIRS 171688]).

- **Cask Trolleys**–Cask trolleys are used to move transportation casks and site-specific casks through the DTF to the various processing areas. These trolleys are part of the cask preparation subsystem. To meet the design bases requirements, the trolleys are designed to stop upon loss of power (Section 3.1.1.1.30). The trolleys are designed to prevent slap down of their load under design loading conditions, including design basis earthquakes (Section 3.1.1.1.31). The trolley speed is such that a collision would not cause the trolley to drop its load (Section 3.1.1.1.35). These requirements are met by rail and trolley design, limiting the speed and providing restraints on the load. In the event of a credible fire, the temperature of the trolley will not reach a level that would make it drop its load (Section 3.1.1.1.37). A tipover and breach of a cask while on the trolley due to a loss of power or a spurious signal caused by a fire will have a probability of less than 1×10^{-4} over the life of the facility (Section 3.1.1.1.38). Loaded transfer trolleys shall not derail or drop their load (Section 3.1.1.1.36).

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

  Operators control the cask trolleys from a local control station.

  The cask trolleys are ITS and ride on a rail system. They are rotated by turntables, making a fixed, electrical-feed system impractical. As a result, the cask trolleys are battery powered. There are five battery-powered trolleys in the DTF. Provisions are made to recharge the batteries in the trolleys' primary operating locations. The batteries are sealed, gel-type, and there are no hydrogen generation hazards. The trolley drive train consists of two motors connected to the drive wheels through a gear reducer. One motor is used to drive the trolley, while the other motor provides redundancy in case the first motor fails. If the instrumentation and control systems lose their power, these systems are designed to fail-safe and give accurate indication upon power restoration

- **Cask Pedestals and Hold-Down Devices**–Pedestals are used to position and support the transportation casks and site-specific casks on trolleys at a consistent height so that it can be docked to the waste transfer cell docking station. The cask pedestals are classified as ITS. The pedestals and hold-down devices are designed for loading

conditions associated with a DBGM-2 seismic event and to a "no tipover" safety function will be maintained for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.33).

The pedestals have a primary support structure of carbon steel. The parts of the pedestals that directly contact transportation casks are made of stainless steel.

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

Hold-down devices are used to securely fasten transportation casks, site-specific casks, and pedestals to trolleys. Loaded transfer trolleys shall not derail or drop their load (Section 3.1.1.1.36). A tipover and breach of a cask while on the trolley due to a loss of power or a spurious signal caused by a fire will have a probability of less than 1×10^{-4} over the life of the facility (Section 3.1.1.1.38). Specific mounting devices accommodate various configurations of transportation casks and site-specific casks. The hold-down devices are classified as ITS.

- **5-ton Cask Pedestal Gantry Crane**–The cask pedestal gantry crane places pedestals on cask trolleys. The crane is classified as non-ITS.

  The rated capacity of the crane exceeds the weight of the heaviest anticipated load, with design margins specified in CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

  The structural materials of the crane and its components are constructed of margins specified in CMAA 70-2000 (CMAA 2000 [DIRS 153997]). The crane rails are carbon steel.

  The cask pedestal gantry crane interfaces with crane rails and the electrical power system, which provides power for the electric bridge, trolley, hoist motors, and brakes. The crane operates in a potentially surface contaminated area, but no airborne contamination is expected. Therefore, the crane is designed to limit the retention of contamination or facilitate decontamination (Section 3.5.5.2).

  Access from structures and moveable equipment to the crane is available for control, inspection, maintenance, and repair, as required.

- **Trolley Tracks and Turntables**–Cask trolleys move on a system of rails embedded in the floor of the DTF. These rails are connected to turntables used to change the direction of the trolleys. The turntables are classified as ITS.

  There are three cask turntables in the Cask/MSC/WP preparation system. Each is designed with a safety margin to support the heaviest loaded transportation cask and trolley per ASME-NOG-1-2002 (ASME 2002 [DIRS 158891]). The turntables are designed for stability and prevention of a tipover of any waste container on the table for loading conditions associated with a DBGM-2 seismic event. In addition, the turntable will have a sufficient seismic design margin to ensure that a "no tipover" safety function

is maintained for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.21). The engineered features include mechanical locking devices and position detectors/interlocks in the turntable control circuitry. A tipover and breach of a cask while on a turntable due to a loss of power or spurious signal caused by a fire will have a probability of less than 1×10^{-4} over the life of the facility. In the event of a credible fire in an area where waste forms are present, the temperature of the turntable will not reach a level that would cause a drop of a cask (Sections 3.1.1.1.22 and 3.1.1.1.23). The turntables operate in a potentially contaminated area. Therefore, the turntables are designed to limit the retention of contamination or facilitate decontamination (Section 3.5.5.2).

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

Operators control the cask turntables from a local control station.

The turntable has two electric motors. One motor rotates the turntable by powering drive gear that meshes with ring gear at the base of the turntable. The second motor engages and disengages a locking mechanism that holds the turntable in position when aligned with the trolley tracks. A loss of power will not result in a tipover or breach of the cask while on a turntable (Section 3.1.1.1.23).

Access to the turntable is available for control, inspection, maintenance, and repair, as required.

- **20-ton Cask Docking Ring Crane**–The 20-ton cask docking ring crane is used to install cask-docking rings and lift lighter loads associated with cask preparation and restoration. The crane is classified as non-ITS.

  The rated capacity of the cask docking ring crane exceeds the weight of the heaviest anticipated load, with design margins specified in CMAA 74-2000 (CMAA 2000 [DIRS 154319]) (Section 3.1.2.1).

  The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with applicable codes and standards. The crane rails are carbon steel.

  The cask docking ring crane interfaces with crane rails and the electrical power system, which provides power for the electric bridge, trolley, hoist motors, and brakes. The crane does not directly contact equipment that may be contaminated and is located in an area where no airborne contamination is expected. Therefore, there are no design or manufacturing requirements for the crane to limit the retention of contamination or facilitate decontamination.

  Operators control the cask docking ring crane from a local control station and pendant control.

Work platforms and other accesses are provided in the DTF for availability to control, inspect, maintain, and repair the crane, as required.

- **Cask Docking Rings**–Cask docking rings are used to connect the transportation casks and site-specific casks to the waste transfer cell docking ports and minimize the spread of contamination. An assembly, consisting of an inner-docking ring and outer docking ring, performs these functions. The inner ring forms the seal with the upper face of the lid and forms the seal with the lower face of the cell plug to protect the bottom face of the plug and the upper face of the lid from contamination. The outer ring forms a seal to the mobile slab and to the top of the cask to minimize the spread of contamination from the waste transfer cell to the cask and MSC docking room (Room 1069). Docking rings are also used to dock casks with DPCs to the DPC cutting/waste package dry remediation cell (Room 1097). Docking rings are classified as non-ITS.

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

  There are several sizes of docking rings to fit various diameters of transportation casks and site-specific casks. These specialized components create seals and confine contamination within the waste transfer cell. The docking rings operate in a contaminated area. Therefore, the docking rings are designed to limit the retention of contamination and facilitate decontamination (Section 3.5.5.2).

- **Jib Crane**–The jib crane is used to lift lighter loads associated with cask preparation.

  The rated capacity of the jib crane exceeds the weight of the heaviest anticipated load, with design margins specified in CMAA 74-2000 (CMAA 2000 [DIRS 154319] (Section 3.1.2.1).

  The structural materials of the crane and its components are constructed of proven performance materials and comply with applicable codes and standards. The jib crane is classified as non-ITS.

  The jib crane operates in a potentially contaminated area. Therefore, the crane is designed to limit the retention of contamination and facilitate decontamination (Section 3.5.5.2).

4.1.1.1.4.2 Waste Package Preparation Subsystem Major Components

- **50-ton Waste Package Handling Cranes**–Two 50-ton waste package handling cranes are used to transfer empty waste packages from SRTCs to waste package trolleys, one for each waste package receipt line. Both cranes are classified as non-ITS. The 50-ton waste package handling crane that operates in the waste package/naval cask SRTC receipt area (Room 1058) is not used while a naval cask is present and parked in that area. This prevents the crane from falling on the naval casks as a result of a seismic event. The other 50-ton crane operates in the waste package SRTC receipt area (Room 1059) where other waste forms are not present.

The 50-ton waste package handling cranes are a top running, double girder bridge crane, with electric bridge, trolley, and hoist drives. Each crane has one trolley and one hoisting unit. The bridge and trolley each have two independent drives consisting of a drive motor with a brake and a self-contained gear reducer. The drives operate simultaneously when moving the bridge or trolley.

The rated capacity of the crane exceeds the weight of the heaviest waste package and associated lifting devices, with design margins specified in CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with applicable codes and standards. The crane rails are carbon steel.

The 50-ton waste package handling cranes interface with crane runways and the electrical power system, which provides power for the bridge, trolley, hoist motor, and brakes. The cranes do not directly contact transportation casks or other equipment that may be contaminated and are located in an area where minimal contamination is expected. Therefore, there are no design or manufacturing requirements for the cranes to limit the retention of contamination or facilitate decontamination.

Operators control the 50-ton waste package handling cranes from a local console providing the operator with an unobstructed view of waste package handling operations.

Work platforms and other access are provided in the DTF for availability to control, inspect, maintain, and repair the crane as required.

- **Waste Package Lifting Yoke**–The waste package lifting yoke is used to lift the empty waste packages and is classified as ITS.

  The waste package lifting yoke has a beam that supports two lifting arms and connects to a crane pulley block. A motor-driven assembly drives the arms, which are on opposite sides of the beam. The waste package lifting yoke uses interchangeable arms. A jack actuates a locking mechanism on each arm to secure the waste package.

  The waste package lifting yoke interfaces with the 50-ton waste package handling crane pulley block, waste package collar trunnions, and electrical power system. The yoke only contacts empty unused waste packages. Therefore, the yoke is not designed and manufactured to limit the retention of radiological contamination or to facilitate decontamination.

  The rated capacity of the lifting yoke exceeds the weight of the heaviest anticipated loads, with design margins specified in ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]). The waste package lifting yokes are designed for loading conditions associated with a DBGM-2 seismic event and to ensure that a “no drop” safety function is maintained for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.20).

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

An operator controls the waste package lifting yoke from the same local console from where the 50-ton waste package handling crane is operated.

The waste package lifting yoke is maintained and periodically tested in accordance with ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]) and ASME B30.20-1993 (ASME 2003 [DIRS 171688]).

- **Waste Package Trolleys**–The waste package trolleys are used to transport waste packages to various locations in the DTF. The waste package trolleys are classified as ITS. To meet the design bases requirements, the trolleys are designed to stop upon loss of power (Section 3.1.1.1.30). The waste package trolleys are designed for loading conditions associated with a DBGM-2 seismic event and to a "no tipover" safety function for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.32). The waste package trolleys are designed to prevent slap down of their load under design loading conditions, including design basis earthquakes. The trolleys are designed so that collisions with objects will not cause the trolley to drop its load. These requirements are met by the rail and trolley design, limiting the speed and providing restraints on the load (Section 3.1.1.1.35). Loaded transfer trolleys shall not derail or drop their load (Section 3.1.1.1.36). In the event of a credible fire in an area where waste forms are present, the temperature of the waste package trolley will not reach a level that would make it drop its load (Section 3.1.1.1.37). A tipover and breach of a cask while on a waste package trolley due to a loss of power or a spurious signal caused by a fire will have a probability of less than 1×10^{-4} over the life of the facility (Section 3.1.1.1.38).

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

  The waste package trolleys can also be configured to transport a naval cask. Operators control the cask trolleys from a remote control station. The trolleys operate in a potentially contaminated area. Therefore, the trolley is designed to limit the retention of contamination and facilitate decontamination (Section 3.5.5.2).

  Waste package trolleys ride on a rail system in a straight line and are powered by the fixed, electrical power system. The trolley drive train consists of two motors connected to the drive wheels through a gear reducer. One motor is used to drive the trolley and the other motor provides redundancy in case the first motor fails. If the instrumentation and control systems lose their power, they are designed to fail-safe and give accurate indication upon power restoration.

- **Pedestals and Hold-Down Devices**–Pedestals are used by the waste package preparation subsystem to ensure a consistent waste package height when mounted on the waste package trolley. Hold-down devices ensure the waste package and pedestal are securely fastened to the trolley. Specific mounting devices accommodate the various

designs of waste packages. The pedestals and hold-down devices are classified as ITS. The pedestals and hold-down devices are designed for loading conditions associated with a DBGM-2 seismic event and to a "no slapdown" safety function for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.34).

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

The primary support structure for the pedestals is made of carbon steel. Parts that directly contact the waste packages are made of stainless steel. Hold-down devices come in different configurations to accommodate various waste package designs.

- **Trolley Rails**–Waste package trolleys move on a system of rails embedded in or on the floor of the DTF. The rails run straight and do not rely on turntables. The rail system is classified as ITS. The system is designed to provide a stable platform for a waste package trolley.

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

- **Waste Package Docking Rings**–Docking rings are used to connect waste packages to the waste transfer cell docking ports and minimize the spread of contamination. An assembly, consisting of an inner-docking ring and outer docking ring, performs these functions. The inner ring forms the seal with the upper face of the lid and lower face of the cell plug to protect the bottom face of the plug and upper face of the lid from contamination. The outer ring forms a seal to the mobile slab and top of the waste package to minimize the spread of contamination from the waste transfer cell. Docking rings are not used for naval casks or for waste packages prepared for receiving naval canisters. Docking rings are classified as non-ITS.

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

  There are several sizes of docking rings to fit various diameters of waste packages. These specialized components create seals that confine contamination within the waste transfer cell. The docking rings operate in a contaminated area. Therefore, the waste package docking rings are designed to limit the retention of contamination and to facilitate decontamination (Section 3.5.5.2).

4.1.1.1.4.3 Cask Restoration Subsystem Major Components

There are no major components associated with the cask restoration subsystem at this time. This subsystem primarily uses equipment that is part of the cask preparation subsystem, including the 200-ton cask handling crane, 200-ton naval cask handling crane, 25-ton material handling crane, 20-ton cask docking ring handling crane, lifting yokes, trolleys, pedestals and hold-down devices, trolley rails, and turntables.

4.1.1.2 Canister Handling Facility

4.1.1.2.1 Cask Preparation Subsystem Description

The cask preparation subsystem prepares casks for waste transfer. Loaded transportation casks are delivered on SRTCs, LWTs, or OWTs from the cask receipt and return system at the entrance vestibule (Room 1036) of the CHF. Unloaded site-specific casks or loaded site-specific casks are delivered by site-specific cask transporters from the SNF aging system and moved on SRTCs to Room 1036. A radiological survey is performed on the cask and transport system.

Transportation cask personnel barriers and impact limiters are removed, if applicable, using the 20-ton entrance vestibule handling crane. A cask inspection and radiation survey is performed on areas that were previously inaccessible. The cask is moved to the canister transfer cell (Room 1033) where the tie-downs and stabilizers are removed. The cask is then upended and placed inside a designated pit inside Room 1033 using the 200-ton cask handling crane. The cask is prepared for transfer operations inside the pit, including gas sampling, venting for loaded casks, and removing lid bolts. For casks with an outer lid and inner lid, the outer lid is removed and the bolts of the inner lid are removed. The SNF/HLW transfer system performs the waste transfer.

The cask preparation subsystem consists of areas of the CHF on Level 0 ft, and upper regions of the building for cranes and crane maintenance above Level 64 ft. The crane areas include provisions for recovery and maintenance. The details of the rooms used by the cask preparation subsystem are shown on drawings listed in Appendix B.

4.1.1.2.2 Waste Package Preparation Subsystem Description

The waste package preparation subsystem prepares empty waste packages designed for DOE SNF/HLW canisters and naval canisters for waste transfer operations within the CHF. Empty waste packages are moved vertically from the Warehouse and Non-Nuclear Receipt Facility through the cask receipt and return system on an SRTC through the entrance vestibule (Room 1036). An empty waste package with its inner lid is moved from Room 1036 to the canister transfer cell (Room 1033). The middle and outer waste package lids are removed and moved to the CHF waste package closure cell. The empty waste package is placed inside a designated pit inside Room 1033 using the 100-ton waste package and canister handling crane. The shield doors to Room 1033 are closed and the waste package is ready for waste transfer operations. The SNF/HLW transfer system performs the waste transfer operation.

The waste package preparation subsystem consists of areas of the CHF on Level 0 ft and upper regions of the building for cranes and crane maintenance above Level 64 ft. The crane areas include provisions for recovery and maintenance. A description of the activities and details of the rooms used by the waste package preparation subsystem are shown on drawings listed in Appendix B.

4.1.1.2.3 Cask Restoration Subsystem Description

The cask restoration subsystem receives unloaded transportation casks and loaded or unloaded site-specific casks from the SNF/HLW transfer system after completion of waste transfer.

Cask restoration activities include lifting the cask with the 200-ton cask handling crane and placing it on its conveyance; inspecting the cask; replacing impact limiters, as necessary; surveying the casks; and closing the casks. Decontamination is not anticipated because canistered waste is not expected to result in the external or internal cask contamination of unacceptable levels. For loaded site-specific casks, additional steps include filling the site-specific cask with an inert gas, as required, and performing lid leak tightness tests.

The cask restoration subsystem consists of areas of the CHF on Level 0 ft within the transfer pits and upper regions of the building for cranes and crane maintenance above Level 64 ft. The crane areas include provisions for recovery and maintenance. The details of the rooms used by the cask restoration subsystem are shown on drawings listed in Appendix B.

4.1.1.2.4 Major Components

4.1.1.2.4.1 Cask Preparation Subsystem Major Components

- **20-ton Entrance Vestibule Crane**–The 20-ton entrance vestibule crane is used inside the CHF to remove and attach impact limiters and personnel barriers to casks entering and exiting the CHF. The crane is classified as non-ITS.

  The 20-ton entrance vestibule crane is a top-running, double-girder bridge crane with electric bridge, trolley, and hoist drives. The crane contains a single trolley. Two motors with self-contained gear reducers, one on each side of the bridge, drive the bridge. A single motor with a self-contained gear reducer drives the trolley. The design of the crane is such that a seismic event does not cause the crane to overturn, derail, lose any main structural components, or drop any loads that could have an adverse impact on a transportation cask or site-specific cask containing SNF or HLW.

  The rated capacity of the crane exceeds the weight of the heaviest anticipated load and associated lifting devices with design margins specified in ASME NOG-1-2002 (ASME 2002 [DIRS 158891]) and CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

  The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

  Interfaces between the crane and other facility systems include the basic structural connections between the crane runways and supporting building walls. The crane also ties to the electrical power system, which provides power for the electric bridge, trolley, hoist motors, and brakes. There is an uninterruptible power supply for the crane instrumentation and control system. If the instrumentation and control systems lose power, they are designed to fail-safe and give accurate indication when power is restored.

  The 20-ton entrance vestibule crane is operated by pendant controls inside the entrance vestibule of the CHF. There is a single manual control mode for the crane.

The 20-ton entrance vestibule crane does not directly contact casks, equipment, or components that may be contaminated; therefore, no specific design or manufacturing requirements is imposed to limit the retention of contamination or to facilitate decontamination.

Work platforms and other access are provided in the CHF for availability to control, inspect, maintain, and to repair the crane as required.

- **200-ton Cask Handling Crane**–The 200-ton cask handling crane is used to upend transportation casks and site-specific casks into a vertical position and move them into the cask preparation pit (P002), or MSC/MSC loading pit (P003 or P004). The crane has an auxiliary hoist that is used for maintenance and recovery activities. The crane is classified as ITS.

  The 200-ton cask handling crane is a top running, double-girder bridge crane, with electric bridge, trolley, and hoist drives. The crane has a single trolley and single hoisting unit. The bridge and trolley each have two independent drives consisting of a drive motor with a brake and a self-contained gear reducer. The drives operate simultaneously when moving the bridge or trolley. The crane trolley structure, bridge structure, hoisting drive train, and load gripping device are classified as ITS. The drop rate for the cask handling crane is less than or equal to 1×10^{-5} drops/transfer, regardless of cause (Section 3.1.1.1.1). The crane speed is limited to prevent a cask breach following a collision (Sections 3.1.1.1.12). The cask handling crane is designed for loading conditions associated with a DBGM-2 seismic event and to ensure a "no drop" safety function for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.11).

  The rated capacity of the crane exceeds the combined weight of the heaviest transportation cask and associated lifting devices with the design margins specified in ASME NOG-1-2002 (ASME 2002 [DIRS 158891]) and CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

  The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

  Crane interfaces include those between the crane and runways supported by building walls and the crane and the electrical power system, which supplies power to the electric bridge, trolley, and hoist motor and brakes. On loss of power, the crane is designed to stop, retain the load and enters a locked mode upon restoration of power, the crane stays in the locked mode until operator action is taken (Section 3.1.1.1.2). The electrical power system also supplies uninterruptible power to the instrumentation and control system. If the instrumentation and control systems lose power, they are designed to fail-safe and give accurate indication when power is restored. In the event of a credible fire in an area where waste forms are present, the temperature of the cask handling crane will not reach a level that would make it drop its load. A drop of a load from the cask handling crane due to a spurious signal caused by a fire will have a probability of less

than 1×10^{-4} over the life of the facility (Sections 3.1.1.1.18 and 3.1.1.1.19). The cask handling crane will not be capable of exerting sufficient force during transfer to breach a cask while attempting to overcome mechanical constraints (Section 3.1.1.1.16).

Engineered features prevent the cranes and loads from contacting structures or major SSCs. These engineered features include mechanical stops, as well as limit switches and interlocks in the crane control circuitry. Limit switches and interlocks stop the cranes or hoisting before mechanical stops that exceed safety limitations are reached. These thresholds include limiting the height that the load can be lifted to prevent exceeding the drop height (Sections 3.1.1.1.4 and 3.1.1.1.5). These interlocks will be entered into the crane software to match the cask configuration to be lifted and administratively controlled. Interlocks also prevent the cranes from lifting loads weighing more than the load capacity. Other interlocks prevent over travel (in forward and reverse), collisions with other cranes, load drops, and load tilting potentially resulting in damage to lift points or to the lifting yokes. The crane is operated locally in the canister transfer cell (Room 1033) from a pendant or from a control console located inside one of the operating galleries (Room 1021 or 1017) that provides operators with an unobstructed view. There is a single manual control mode for the crane.

The 200-ton cask handling crane is considered to be potentially contaminated but does not directly contact transportation casks or other equipment that may be contaminated. Therefore, specific design and manufacturing requirements are imposed that limit the retention of contamination or to facilitate decontamination. (Section 3.5.5.2)

Work platforms and other access are provided in the CHF for availability to control, inspect, maintain, and to repair the crane as required.

- **15-ton Maintenance Crane for Cask Handling Crane**–This 15-ton crane is used for maintenance of the 200-ton cask handling crane and is located above the cask handling crane in crane maintenance Room A (Room 3006). This crane is non-ITS. No components of the crane are relied upon to prevent or mitigate Category 1 or Category 2 event sequences. The crane and loads do not move over a loaded transportation cask or site-specific cask. Therefore, the crane and loads cannot drop onto loaded casks or site-specific casks.

  The 15-ton maintenance crane is a top running, double-girder bridge crane, with electric bridge, trolley, and hoist drives. The crane contains a single trolley. The bridge and trolley drive each use a single motor with self-contained gear reducers.

  The rated capacity of the crane exceeds the weight of the heaviest anticipated loads and associated lifting devices with the design margins specified in CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

  The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

Interfaces between the crane and other facility systems include the basic structural connections between the crane runways and the supporting building walls. The crane also ties to the electrical power system, which provides power for the electric bridge, trolley, hoist motors, and brakes. The maintenance crane is operated by pendant control.

The crane is located in an area that has a low potential for contamination. However, the crane is provided with provisions to limit the retention of contamination or to facilitate decontamination (Section 3.5.5.2).

Work platforms and other access are provided in the CHF for availability to control, inspect, maintain, and to repair the crane as required.

- **Cask Lifting Yoke**–The cask lifting yoke provides a lifting interface between the 200-ton cask handling crane and transportation casks or site-specific casks. It is used to tilt transportation casks or site-specific casks from a horizontal or vertical position and to and from the cask preparation pit (P002), MSC/waste package loading pit (P003 or P004). The lifting yoke is classified as ITS. The drop rate for the cask lifting yoke is less than or equal to 1×10^{-5} drops/transfer, regardless of cause (Section 3.1.1.1.1). The cask lifting yokes are designed for loading conditions associated with a DBGM-2 seismic event and to ensure that a "no drop" safety function is maintained for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.20).

  The cask lifting yoke uses interchangeable arms to accommodate the different type casks and site-specific casks. The cask lifting yoke attaches directly to the hoisting mechanism of the 200-ton cask handling crane. A yoke beam supports the yoke arms and connects to the crane pulley block interface. A motor-driven assembly to engage the cask or site-specific cask controls two lifting arms on opposite sides of the yoke beam. Each arm has a trunnion locking system to secure the attachment to the cask or site-specific casks.

  The rated capacity of the cask lifting yoke is specified to envelope the weight of the heaviest anticipated load plus design margins specified in ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]).

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

  Interfaces between the cask lifting yoke and other facility systems include the basic structural connection between the yoke beam and the cask handling crane pulley block. Interfaces also include the structural interface between the lifting yoke lifting arms and the transportation cask or site-specific cask and the electrical interface between the lifting arm motor drive and the electrical power system.

  The lifting arm motor drive is operated from the pendant or console control that operates the 200-ton cask handling crane.

  The cask lifting yoke comes into direct contact with transportation casks, site-specific casks, or other equipment that may be contaminated. Therefore, specific design or

manufacturing requirements are imposed that limit the retention of contamination and facilitate decontamination (Section 3.5.5.2).

The cask lifting yoke is maintained and periodically tested in accordance with the requirements of ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]) and ASME B30.20-1993 (ASME 2003 [DIRS 171688]).

Work platforms and other access are provided in the CHF for availability to control, inspect, maintain, and to repair the crane as required.

- **Cask Pit Pedestal, MSC Pit Pedestal, and Waste Package Pit Pedestal**–A transportation cask pit pedestal is used to support transportation casks inside the cask preparation pit (Room P002) of the canister transfer cell (Room 1033). A MSC pit pedestal is used to support site-specific casks inside the MSC/waste package pits (Rooms P003 or P004) of the canister transfer cell. A waste package pit pedestal is used to support waste packages inside the MSC/waste package pit (Rooms P003 or P004) of the canister transfer cell. Pedestals ensure a consistent cask or waste package height in the pit for preparation and transfer operations and provide seismic restraint for casks in the pits. The pit pedestals are classified as non-ITS.

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

  The primary support structure for the pedestals is made of carbon steel. Portions of the pedestals that directly contact casks are made of stainless steel.

- **Cask, MSC, and Waste Package Pit Crush Pad**– Crush pads will limit the impact energy of a dropped canister, cask, or waste package to be less than or equal to the impact energy associated with a drop of a canister, cask, or waste package onto an unyielding surface from their maximum specified drop height (Sections 3.1.1.1.28 and 3.1.1.1.29). The transportation cask, MSC, and waste package pit crush pad are classified as ITS.

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

- **Pit Movable Platform**–The movable platform is used to provide personnel access to transportation casks and site-specific casks when they are in the cask preparation pit, MSC/waste package loading pit. The movable platform is also used to access waste packages inside the waste package pit as part of the waste package preparation subsystem. The movable platform is classified as non-ITS.

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

- **Cask and Waste Package Shielded Pit Cover**–The shielded pit covers are used to cover the cask and waste package pits. The covers provide shielding when personnel are in the canister transfer cell. The cask pit protective covers will be designed to

demonstrate a sufficient seismic design margin to a "shielding integrity remains intact" safety function. The waste package/MSC pit protective covers will be designed for loading conditions associated with a DBGM-1 seismic event and to demonstrate a "no failure" safety function (Sections 3.1.1.1.24 and 3.1.1.1.25). Radiation exposure to workers due to inadvertent actuation of the pit protective covers is precluded such that this is not a Category 1 event (Section 3.1.11.27). Shielded pit covers are classified as ITS.

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards. The pit covers will be designed strong enough to prevent a waste package or site-specific cask from penetrating the pit cover and falling into the pit (Section 3.1.1.1.26).

4.1.1.2.4.2 Waste Package Preparation Subsystem Major Components

- **100-ton Waste Package and Canister Handling Crane**–The 100-ton waste package and canister handling crane is located in the canister transfer cell (Room 1033). The crane supports the Cask/MSC/WP preparation system by handling empty waste packages for transfer and the SNF/HLW transfer system by transferring canisters, handling loaded waste packages, and moving the waste package and pallet to the waste package transporter. An auxiliary hook is used for process and maintenance activities. The crane is classified as ITS.

  The 100-ton waste package and canister handling crane is a top-running, double-girder bridge crane, with electric bridge, trolley, and hoist drives. The crane has a trolley and a redundant hoisting unit. The bridge and trolley each have two independent drives consisting of a drive motor with a brake and a self-contained gear reduction unit. The independent drives operate simultaneously when moving the bridge or trolley. The crane trolley structure, bridge structure, hoisting drive train, and load gripping device are classified as ITS. The drop rate for the waste package and canister handling crane is less than or equal to 1×10^{-5} drops/transfer, regardless of cause (Section 3.1.1.1.1). The probability of dropping handling equipment from a crane onto a canister is less than or equal to 1×10^{-5} for each canister transferred (Section 3.1.1.1.3). The waste package and canister handling crane shall not be capable of exerting sufficient force to breach a canister or waste package while attempting to overcome mechanical constraints (Section 3.1.1.1.40). The waste package and canister handling crane will not move above a speed limit that would breach a loaded sealed waste package, a standardized DOE SNF canister, a DOE HLW canister, a naval SNF canister, a DOE MCO, a loaded sealed site-specific cask, or a DPC (Section 3.1.1.1.15). The crane and its rigging are designed for loading conditions associated with a DBGM-2 seismic event and to ensure a "no drop" safety function for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.11). In the event of a credible fire in an area where waste forms are present, the temperature of the waste package and canister handling crane will not reach a level that would make it drop its load. A drop of a load from the waste package and canister handling crane due to a spurious signal caused by a fire will have a probability of less than 1×10^{-4} over the life of the facility (Sections 3.1.1.1.18 and 3.1.1.1.19).

The rated capacity of the crane exceeds the weight of the heaviest loaded waste package and associated lifting devices with the design margins specified in ASME NOG-1-2002 (ASME 2002 [DIRS 158891]) and CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

Crane interfaces include those between the crane and runways supported by building walls and the crane and the electrical power system, which supplies power to the electric bridge, trolley, and hoist motor and brakes. On loss of power, the crane is designed to stop, retain the load, and enters a locked mode. Upon restoration of power, the crane stays in the locked mode until operator action is taken (Section 3.1.1.1.2). The electrical system also supplies uninterruptible power to the instrumentation and control system. If the instrumentation and control systems lose power, they are designed to fail-safe and give accurate indication when power is restored.

Engineered features prevent the cranes and loads from inadvertent contact with SSCs. These engineered features include bumpers and mechanical stops, as well as limit switches and interlocks in the crane control circuitry. Limit switches and interlocks stop the cranes or hoisting before mechanical stops that exceed safety limits are reached. This includes limiting the height that the load can be lifted to prevent exceeding the drop height (Section 3.1.1.1.4 and 3.1.1.1.10). Interlocks also prevent cranes from lifting loads weighing more than the load capacity. Other interlocks prevent over travel (in forward and reverse) and collisions with other cranes, load drops, and load tilting potentially resulting in damage to lift points or the tilting yoke.

During preparation operations or maintenance, the crane is operated locally from a pendant control. During canister and loaded waste package transfer operations, the crane is operated remotely from control consoles in a shielded area adjacent to the canister transfer cell. During preparation operations, the single control mode for the crane is manual mode. During transfer operations, the control mode for the crane is automatic with operator validation. The crane can only be operated from one location at a time.

The 100-ton waste package and canister handling crane do not directly contact waste package, canisters or other equipment that may be contaminated. The crane is located in an area that has a low potential for contamination. However, the crane is provided with some provisions to limit the retention of contamination or to facilitate decontamination (Section 3.5.5.2).

Work platforms and other access are provided in the CHF for availability to control, inspect, maintain, and to repair the crane as required.

- **15-ton Maintenance Crane for Waste Package and Canister Handling Crane**–The 15-ton maintenance crane is used to maintain the 100-ton waste package and canister handling crane. This crane is located above the waste package and canister handling

crane in the crane maintenance Room B (Room 3011). It is separate and distinct from the maintenance crane used for the cask handling crane. The crane is not ITS. No components of the crane are relied upon to prevent or mitigate Category 1 or Category 2 event sequences. The crane and loads do not move over loaded transportation casks, site-specific casks, or waste packages. Therefore, the crane and loads cannot drop onto loaded waste packages or canisters.

The maintenance crane is a top running, double-girder bridge crane, with electric bridge, trolley, and hoist drives. The crane contains a single trolley. Two motors with self-contained gear reducers, one on each side of the bridge, drive the bridge. A single motor with a self-contained gear reducer drives the trolley.

The rated capacity of the crane exceeds the weight of the heaviest anticipated load and associated lifting devices with the design margins specified in CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1). The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

Interfaces between the crane and other facility systems include the basic structural connections between the crane runways and the supporting building walls. The crane also ties to the electrical power system, which provides power for the electric bridge, trolley, hoist motors, and brakes. The maintenance crane is operated by pendant control.

The crane is located in an area that has a low potential for contamination. However, the crane is provided with some provisions to limit the retention of contamination or to facilitate decontamination (Section 3.5.5.2).

Work platforms and other access are provided in the CHF for availability to control, inspect, maintain, and to repair the crane as required.

- **Waste Package Lifting Yoke**–The waste package lifting yoke provides a lifting interface between the 100-ton waste package and canister handling crane and empty or loaded waste packages. The waste package lifting yoke uses adjustable arms to accommodate different waste packages. The lifting yoke is classified as ITS. The drop rate for the waste package lifting yoke is less than or equal to 1×10^{-5} drops/transfer, regardless of cause (Section 3.1.1.1.1). The waste package lifting yoke is designed for loading conditions associated with a DBGM-2 seismic event and to ensure that a "no drop" safety function is maintained for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.20).

  The waste package lifting yoke attaches directly to the hoisting mechanism of the 100-ton waste package and canister handling crane. A yoke beam supports the yoke arms and connects to the crane pulley block interface. Two lifting arms on opposite sides of the yoke beam are controlled by a motor-driven assembly to engage the waste package trunnions. Each arm has a trunnion locking system to secure the attachment to the waste package.

The rated capacity of the waste package lifting yoke is specified to envelope the weight of the heaviest anticipated load with design margins specified in ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]).

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

Interfaces between the waste package lifting yoke and other facility systems include the basic structural connection between the yoke beam and the handling crane pulley block. Additional interfaces include the structural interface between the lifting yoke lifting arms and the waste package trunnion collar and the electrical interface between the lifting arm motor drive and the electrical power system. The lifting arm motor drive is operated from the control consoles that operate the 100-ton waste package and canister handling crane and the 200-ton cask handling crane.

The waste package lifting yoke may come into direct contact with the waste package or other equipment that may be contaminated. Therefore, specific design and manufacturing requirements are imposed that limit the retention of contamination and facilitate decontamination (Section 3.5.5.2).

The waste package lifting yoke is maintained and periodically tested in accordance with ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]) and ASME B30.20-1993 (ASME 2003 [DIRS 171688]).

- **Waste Package Pit Pedestal**–See discussion under Cask Preparation Subsystem Major Components

- **Waste Package Pit Impact Limiter**–See discussion under Cask Preparation Subsystem Major Components

- **Waste Package Pit Protective Cover**–See discussion under Cask Preparation Subsystem Major Components

4.1.1.2.4.3 Cask Restoration Subsystem

The cask restoration subsystem uses the same major components as the cask preparation subsystem. No additional major components are required.

4.1.1.3 Fuel Handling Facility

4.1.1.3.1 Cask Preparation Subsystem Description

The cask preparation subsystem prepares transportation casks and site-specific casks for waste transfer operations. Loaded transportation casks are received from the cask receipt and return system on railcars or truck trailer at the entrance vestibule (Room 1001) of the FHF. Empty site-specific casks are received from the non-nuclear handling system and loaded or unloaded site-specific casks are received from the SNF aging system outside the entrance vestibule (Room 1001).

The personnel barriers, impact limiters, and tie-downs are removed, as applicable. Radiological surveys will be performed as required. The import-export trolley is prepared with a pedestal. A 200-ton gantry crane upends the cask and loads it onto the prepared trolley. The import-export trolley moves the cask to the preparation room (Room 1002). The transportation casks or loaded site-specific casks are gas sampled and vented prior to removing the cask lid bolts. The import-export trolley moves the transportation cask or site-specific cask to the main transfer room (Room 1003). A 200-ton bridge crane transfers the transportation cask or site-specific cask onto a transfer trolley. Docking rings are installed and the transfer trolley is then moved into one of the fuel transfer bays. There are three transfer bays within the FHF. Waste packages are placed in Fuel Transfer Bay #1 (Room 1004), which is the closest bay to the entrance to the waste package closure room. Transportation casks are typically docked in Fuel Transfer Bay #2 (Room 1005), which is the center bay. Site-specific casks are typically docked in Fuel Transfer Bay #3 (Room 1006), which is the bay furthest from the waste package closure room. Transportation or site-specific casks can be placed in either Fuel Transfer Bay #2 or #3 as needed. The SNF/HLW transfer system performs the waste transfer.

4.1.1.3.2 Waste Package Preparation Subsystem Description

The waste package preparation subsystem prepares empty waste packages for waste transfer operations. Empty waste packages are received from the non-nuclear handling system through the cask receipt and return system at the entrance vestibule (Room 1001).

The tie-downs are removed and the empty waste package with the inner lid is transferred to the import-export trolley. The waste package middle and outer lids are transferred to the waste package closure cell. The import-export trolley is moved into the preparation room (Room 1002). The waste package is transferred from the import-export trolley to the prepared transfer trolley. The docking ring is installed and the empty waste package is moved to Fuel Transfer Bay #1 (Room 1004) for waste transfer operations.

4.1.1.3.3 Cask Restoration Subsystem Description

The cask restoration subsystem prepares unloaded transportation casks for return to the National Transportation System through the cask receipt and return system and loaded or unloaded site-specific casks to the SNF aging system.

Upon completion of fuel transfer and characterization the fuel transfer system undocks and moves the transportation cask or site-specific cask into the main transfer room (Room 1003). The docking ring is removed and the cask or site-specific cask is transferred to the import-export trolley. The import-export trolley moves to the preparation room (Room 1002), where the lid bolts are installed. Additional steps for loaded site-specific casks include filling the cask cavity with an inert gas and performing a lid leak tightness test. Casks are surveyed and decontaminated as required. The import-export trolley moves to the entrance vestibule (Room 1001) and the transportation cask is transferred to the conveyance where the impact limiters and personnel barriers are installed. Site-specific casks are transferred outside the entrance vestibule for transfer to the SNF aging system.

4.1.1.3.4.1 Major Components

4.1.1.3.4.2 Cask Preparation Subsystem Major Components

- **200-ton Entrance Vestibule Crane**–The 200-ton entrance vestibule crane is a gantry crane located in the entrance vestibule (Room 1001) of the FHF. This crane handles loaded and unloaded transportation casks, empty waste packages, and empty, loaded, and unloaded site-specific casks.

  The 200-ton entrance vestibule crane is used to transfer loaded transportation casks and empty site-specific casks from transportation conveyances (truck trailer or railcar) to the import-export trolley in the vestibule. The crane is also used to transfer empty and loaded site-specific casks from onsite transporters outside of the entrance vestibule to the import-export trolley. In addition, the crane is used to transfer empty transportation and loaded and unloaded site-specific casks from the trolley to a transportation conveyance.

  The 200-ton entrance vestibule crane is a gantry crane with an electric gantry, trolley, and hoist drives. The crane also has a 30-ton auxiliary hoisting unit. The 200-ton entrance vestibule crane is classified as ITS. The crane trolley structure, bridge structure, hoisting drive train, load gripping device, and auxiliary hoisting unit are ITS components. The drop rate for the entrance vestibule crane is less than or equal to 1×10^{-5} drops/transfer, regardless of cause (Section 3.1.1.1.1). This reliability requirement reasonably ensures that cask drops are Category 2 events. The entrance vestibule crane and its rigging are designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate sufficient seismic design margin to ensure a "no drop" safety function for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.11). The entrance vestibule crane will not be capable of moving above a speed limit such that a collision at the speed limit would breach a transportation cask or site-specific cask (Section 3.1.1.1.12). The gantry, hoist, and trolley each have two, independent drives consisting of a drive motor with a brake and a self-contained gear reduction unit. The independent drives operate simultaneously when moving the gantry or trolley. The entrance vestibule crane shall not be capable of exerting sufficient force to breach a cask, waste package, canister, or site-specific cask during transfer while attempting to overcome mechanical constraints (Sections 3.1.1.1.41).

  The rated capacity of the crane exceeds the combined weight of the heaviest transportation cask and the associated lifting devices with design margins specified in ASME NOG-1-2002 (ASME 2002 [DIRS 158891]) and CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

  The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

  Crane interfaces include those between the crane and runways supported by building floors and the crane and the electrical power system, which supplies power to the

electric bridge, trolley, hoist motor, and brakes. Upon loss of power, the crane is designed to stop, retain the load, and enters a locked mode. Upon restoration of power, the crane stays in the locked mode until operator action is taken (Section 3.1.1.1.2). The electrical power system also supplies uninterruptible power to the instrumentation and control system for the crane. If the instrumentation and control systems lose power, they are designed to fail-safe and give accurate indication upon restoration of power. In the event of a credible fire, the temperature of the entrance vestibule crane will not reach a level that would make it drop its load. A drop of a load from the entrance vestibule crane due to a spurious signal caused by a fire will have a probability of less than 1×10^{-4} over the life of the facility (Sections 3.1.1.1.18 and 3.1.1.1.19).

The 200-ton entrance vestibule crane is operated locally from a control console or hand-held pendant in the vestibule. The use of pendants and the positioning of the control console provide the operator with an unobstructed view of operations. The crane can only be operated in the manual mode and the crane can only be operated from one location at a time (pendant or the control console).

Engineered features prevent the crane and load from contacting structures or major SSCs. These features include mechanical stops and bumpers, as well as limit switches and interlocks in the crane control circuitry. Limit switches and interlocks stop the cranes or hoisting before mechanical stops are reached and before any safety limitations are reached. These thresholds include limiting the height that the load can be lifted to prevent exceeding the drop height (Sections 3.1.1.1.4 and 3.1.1.1.8). These interlocks will be entered into the crane software to match the cask configuration to be lifted and administratively controlled. Interlocks also prevent the cranes from lifting loads weighing more than their load capacity. Other interlocks prevent over travel (in forward and reverse), collisions with other cranes, load drops, and load tilting potentially resulting in damage to lift points or the lifting yoke.

The 200-ton entrance vestibule crane does not directly contact unsurveyed transportation casks or other equipment that may be contaminated and the crane is located in an area where no contamination is expected. Therefore, there are no design or manufacturing requirements to limit the retention of contamination or to facilitate decontamination. Radiation detection systems are not installed on the crane.

The 200-ton entrance vestibule crane is protected from the weather by the FHF entrance vestibule structure. However, note that the entrance vestibule crane is rail-mounted, gantry type crane that can be physically moved out of the entrance vestibule to the west of the facility. The crane is expected to be moved out of the vestibule only when required to move site-specific casks into or out of the FHF.

- **Vestibule WP/Cask/MSC Lifting Yoke**–The yoke is a single, adjustable lifting yoke used to lift transportation casks, waste packages and site-specific casks. It enables the operator to tilt transportation casks from a horizontal position on the transportation cask conveyance to a vertical position and it enables moving transportation casks and site-specific casks to the import-export trolley. The yoke is classified as ITS. The drop rate for the vestibule WP/Cask/MSC lifting yoke is less than or equal to 1×10^{-5}

drops/transfer, regardless of cause (Section 3.1.1.1.1). The vestibule WP/Cask/MSC lifting yoke is designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate a sufficient seismic design margin to ensure that a "no drop" safety function is maintained for loading conditions associated with a BDBGM seismic event (Section 3.1.1.1.20).

The yoke uses adjustable arms to accommodate the different transportation casks, waste packages and site-specific casks to be lifted. A yoke beam supports the yoke arms and connects to the crane pulley block interface. The two lifting arms on opposite sides of the yoke beam are controlled by a motor-driven assembly to engage the transportation cask. Each arm has a locking system to secure the attachment to the transportation cask, waste package, or site-specific cask.

The yoke is stored and used inside the entrance vestibule, which protects it form the weather. This entrance vestibule gantry crane will be administratively restricted from operating outdoors during most natural phenomena and other inclement weather unless approved.

The lifting yoke rated capacity exceeds the heaviest anticipated load with design margins specified in ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]).

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

Interfaces between this yoke and other facility systems include the basic structural connection between the yoke beam and the 200-ton vestibule gantry crane pulley block. There is also a structural interface between the yoke lifting arms and the transportation cask and site-specific cask trunnions. There is an electrical interface between the lifting arm motor drive and the normal electrical power system. The lifting arm motor drive is operated from the pendant or the control console that operates the 200-ton entrance vestibule crane.

The yoke comes in contact with transportation casks and loaded site-specific casks that may be contaminated. Therefore, the yoke is designed and manufactured to limit the retention of radiological contamination and to facilitate decontamination (Section 3.5.5.2).

The yoke is maintained and periodically tested in accordance with the requirements of ANSI N14.6-1993 (ANSI 2003 [DIRS 102016]) and ASME B30.20-1993 (ASME 2003 [DIRS 171688]).

- **Import-Export Trolley and Transfer Trolley**-These trolleys move the transportation casks, waste packages, and site-specific casks through the FHF and position them for loading and unloading. The import-export trolley and transfer trolleys are designed for loading conditions associated with a DBGM-2 seismic event. In addition, the import-export trolley and transfer trolleys will demonstrate sufficient seismic design margin to ensure that a "no slapdown" safety function is maintained for a BDBGM

seismic event. The import-export trolley and transfer trolleys are designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate a sufficient seismic design margin to a "no tipover" safety function for loading conditions associated with a BDBGM seismic event (Sections 3.1.1.1.31 and 3.1.1.1.32). In the event of a credible fire in an area where waste forms are present, the temperature of the import-export trolley and transfer trolleys will not reach a level that would make it drop its load. A tipover and breach of a cask while on the import-export trolley and transfer trolleys due to a loss of power or a spurious signal caused by a fire will have a probability of less than 1×10^{-4} over the life of the facility (Sections 3.1.1.1.37 and 3.1.1.1.38).

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

There are two kinds of trolleys; the import-export trolley and transfer trolleys. The import-export trolley is used to move transportation casks, waste packages, and site-specific casks from the entrance vestibule into the main transfer room to a position where the main transfer room bridge crane can attach to the cask or waste package and move it onto a transfer trolley. The import-export trolley does not enter potentially high contamination areas and, therefore, minimizes the potential for the spread of contamination. The trolleys are designed to be configured to fit all types of casks and waste packages and to be easily decontaminated (Section 3.5.5.2).

The trolley drive train consists of two battery operated motors that are connected to the drive wheels through a gear reducer. One motor is used to drive the trolley and the other motor provides redundancy. Upon a loss of power, the import-export trolley and transfer trolleys are designed to stop, retain their load, and enter a locked mode; upon a restoration of power, the import-export trolley and transfer trolleys will stay in the locked mode until operator action is taken (Section 3.1.1.1.30). The import-export trolley and transfer trolleys are designed with an inherent speed limit such that a collision would not cause the trolley to drop its load. Loaded transfer trolleys shall not derail or drop their load (Sections 3.1.1.1.35 and 3.1.1.1.36).

- **Hold-Down Devices**–Hold-down devices ensure that transportation casks, site-specific casks, and waste packages are securely fastened to the import-export trolley and transfer trolley. Mounting devices that connect hold-down devices to casks and waste packages are designed to accommodate the various designs of transportation casks, waste packages, and site-specific casks. Hold-down devices are classified as ITS. The pedestals and hold-down devices will be designed for loading conditions associated with a DBGM-2 seismic event and to demonstrate a "no tipover" safety function is maintained during a BDBGM seismic event. The pedestals and hold-down devices will be designed for loading conditions associated with a DBGM-2 level seismic event and to demonstrate a "no slapdown" safety function during a BDBGM seismic event (Sections 3.1.1.1.33 and 3.1.1.1.34).

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

- **Docking Rings**–Docking rings provide a confinement boundary between the fuel transfer room and the waste package, transportation cask or site-specific cask. There are several types of docking rings to fit the various diameters of transportation casks, waste packages, and site-specific casks. The docking ring assembly maintains the mechanical interface between the transportation cask, waste package, or site-specific cask and the fuel transfer room docking port. Docking rings are classified as non-ITS.

  Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

  The docking rings operate in a contaminated area. Therefore, the docking rings are designed to limit the retention of contamination and to facilitate decontamination (Section 3.5.5.2).

- **200-ton Main Transfer Room Crane**–The main transfer room crane is used in the main transfer room (Room 1003). The crane supports the Cask/MSC/WP preparation system by transferring empty and loaded transportation casks, empty site-specific casks, loaded site-specific casks, unloaded site-specific casks, and empty waste packages from the import-export trolley to transfer trolleys or the canister transfer station. The main transfer room crane also supports the SNF/HLW transfer system by performing canister transfers at the canister transfer station, transferring loaded waste packages from one transfer trolley to another trolley (permitting the loaded waste package to be moved into the waste package positioning cell) and performing sealed waste package load out operations.

  The 200-ton main transfer room crane is a top running, double girder bridge crane, with electric bridge, trolley, and hoist drives. The crane also has a 30-ton auxiliary hoisting unit. The 200-ton main transfer room crane trolley structure, bridge structure, hoisting drive train, load gripping device, and auxiliary hoisting unit are components that are classified as ITS.

  The drop rate for the main transfer room crane is less than or equal to 1×10^{-5} drops/transfer, regardless of cause (Section 3.1.1.1.1). The main transfer room crane and its rigging are designed for loading conditions associated with a DBGM-2 seismic event and to ensure a "no drop" safety function for loading conditions during a BDBGM seismic event (Section 3.1.1.1.11). The main transfer room crane will not be capable of moving above a speed limit such that a collision would breach a loaded sealed site-specific cask, a loaded sealed waste package, a DOE HLW canister, a standardized DOE SNF canister, a naval SNF canister, or a DPC (Section 3.1.1.1.14). The main transfer room crane will not be capable of exerting sufficient force to breach a cask, canister, or waste package while attempting to overcome mechanical constraints (Section 3.1.1.1.17).

  The crane has one trolley with two hoisting units. The bridge and trolley each have two independent drives consisting of a drive motor with a brake and a self-contained gear reduction unit. The independent drives operate simultaneously when moving the bridge or trolley.

The rated capacity of the crane exceeds the combined weight of the heaviest transportation cask and the associated lifting devices, with design margins specified in ASME NOG-1-2002 (ASME 2002 [DIRS 158891]) and CMAA 70-2000 (CMAA 2000 [DIRS 153997]) (Section 3.1.2.1).

The structural materials of the crane and its components are to be of an acceptable type and suitable for the purpose for which the materials are used. The materials comply with the applicable codes and standards. The crane rails are carbon steel.

Interfaces between the 200-ton main transfer room crane and other facility systems include the basic structural connections between the crane runways and the supporting building walls and the ties to the normal electrical supply system, which provides power for the electric bridge, trolley, hoist motors, and brakes. On loss of power, the crane is designed to stop, retain the load and enters a locked mode. Upon restoration of power, the crane stays in the locked mode until operator action is taken (Section 3.1.1.1.2). The electrical system also supplies uninterruptible power to the crane's instrumentation and control systems. If the instrumentation and control systems lose their power, these systems are designed to fail-safe and to give accurate indication upon power restoration. In the event of a credible fire in an area where waste forms are present, the temperature of the main transfer room crane will not reach a level that would make it drop its load. A drop of a load from the main transfer room crane due to a spurious signal caused by a fire is less than 1×10^{-4} over the life of the facility (Sections 3.1.1.1.18 and 3.1.1.1.19).

The 200-ton main transfer room crane is capable of being operated locally or remotely from a control console. The primary operator station and control console are located in the control area adjacent to the main transfer room, which is separated from the main transfer room by a shielding wall with shielded glass windows. The primary operator station relies on use of cameras (augmented by views through the shielded glass windows) to perform movements of loaded, unshielded waste packages. The secondary operator station and control console are located in the main transfer room to provide the operator with an unobstructed view of handling operations when performing transfers of shielded casks or empty waste packages. Interlocks prevent the simultaneous operation of the crane from both consoles. Operation of the crane from either console also requires a permissive electronic input from the central control center.

Engineered features prevent the cranes and loads from contacting structures or major SSCs. These features include mechanical stops and bumpers, as well as limit switches and interlocks in the crane control circuitry. Limit switches and interlocks stop the cranes or hoisting before mechanical stops are reached and before any safety limitations are reached. These thresholds include limiting the height that the load can be lifted to prevent exceeding the drop height (Sections 3.1.1.1.4 and 3.1.1.1.9). These interlocks will be entered into the crane software to match the cask configuration to be lifted and administratively controlled. Interlocks also prevent the cranes from lifting loads weighing more than their load capacity. Other interlocks prevent over travel (in forward and reverse), collisions with other cranes, load drops, and load tilting potentially resulting in damage to lift points or the lifting yoke. The probability of dropping

handling equipment from the main transfer room crane onto a canister is less than or equal to 1×10^{-5} for each canister transferred (Section 3.1.1.1.3).

The 200-ton main transfer room crane will be designed for remote recovery for repair.

The 200-ton main transfer room crane contacts transportation casks and other equipment that may be contaminated and the crane is located in an area where contamination is expected. Therefore, design and manufacturing requirements for the crane limit the retention of contamination and facilitate decontamination (Section 3.5.5.2).

Preplanned access to the crane in the main transfer room crane maintenance room (Room 2013) located above the preparation room allows for inspection, maintenance, and repair.

- **Main Transfer Room WP/Cask/MSC Lifting Yoke**–This lifting yoke is designed to accommodate all casks and waste packages and is identical to the vestibule WP/Cask/MSC lifting yoke. Therefore, the description and classification is the same as the vestibule WP/Cask/MSC lifting yoke. The yoke is classified as ITS. The drop rate for the main transfer room WP/Cask/MSC lifting yoke is less than or equal to 1×10^{-5} drops/transfer, regardless of cause (Section 3.1.1.1.1). The main transfer room WP/Cask MSC lifting yoke will not drop a load during a seismic event (Section 3.1.1.1.20). The main transfer room WP/Cask/MSC lifting yoke is stored and used inside the FHF main transfer room

Interfaces between the yoke and other SSCs include the basic structural connection between the yoke beam and the 200-ton main transfer room crane pulley block. There is also a structural interface between the yoke arms and the trunnions of the lifted loads. There is an electrical interface between the lifting arm motor drive and the normal electrical power system.

Materials of the structural components are suitable for the purpose for which the material is used and comply with applicable codes and standards.

The yoke is maintained and periodically tested in accordance with ANSI N14.6-1993 (ANSI 1993 [DIRS 102016]) and ASME B30.20-1993 (ASME 2003 [DIRS 171688]).

4.1.1.3.4.3 Waste Package Preparation Subsystem Major Components

The waste package preparation subsystem uses equipment that is part of the cask preparation subsystem, including the 200-ton entrance vestibule crane, 200-ton main transfer room crane, WP/Cask/MSC lifting yokes, import-export trolley, transfer trolleys, pedestals, hold-down devices, docking rings, rails, and operator consoles.

4.1.1.3.4.4 Cask Restoration Subsystem Major Components

The cask restoration subsystem uses equipment that is part of the cask preparation subsystem, including the 200-ton entrance vestibule crane, 200-ton main transfer room crane,

WP/Cask/MSC lifting yokes, import-export trolley, transfer trolleys, pedestals, hold-down devices, trolley rails, and operator consoles.

4.1.2 Boundaries and Interfaces

The boundaries and interfaces of the Cask/MSC/WP preparation system are listed in Section 1.1 of this SDD.

4.1.3 Physical Layout and Location

4.1.3.1 Dry Transfer Facility

The DTF is located in the North Portal area of the repository. A list of DTF drawings, including site layout, general arrangements, and section drawings are presented in Appendix B.

4.1.3.2 Canister Handling Facility

A list of CHF drawings, including site layout, general arrangements, and section drawings are presented in Appendix B.

4.1.3.3 Fuel Handling Facility

A list of FHF drawings, including site layout, general arrangements, and section drawings are presented in Appendix B.

4.1.4 Principles of Operation

The operating philosophy and principles presented in this section is based on the YMP technical requirements and bases, and experience and lessons learned in the design, construction, and operation of nuclear processing facilities that perform similar functions as this system. In general, systems may be operated either locally or remotely from a working area or a control station. Operating modes may be both manual and automatic operation.

Based on ALARA requirements, local and manual operations are performed either hands-on, when the worker can stay close or in direct contact with the components and may wear respiratory protection devices or through master/slave manipulator work stations, when the worker needs to be isolated from the nuclear sources. Hands-on operations may require the implementation of local radiation shielding (fixed or temporary) or the use of specific tools (such as long-handled wrenches) if required by ALARA assessments and radiological work permits.

Most cask preparation, waste package preparation, and cask restoration operations are performed locally and manually, following specific operating procedures. Operations are performed in direct contact with the cask using tools and components to remove rings or rims or loosen screws or bolts. Cranes and hoists are used to move components with operators guiding the movement either from local workstations or from control panels. The trolleys are controlled remotely.

4.1.5 System Reliability Features

Limit switches, encoders, and interlocks maintain load path and lift height restrictions. In addition, mechanical end stops are used as protection to prevent cranes or the load from impacting structures or walls. When transportation casks and site-specific casks are lifted, design and procedural controls restrict lift heights and load paths. When waste packages are lifted, mechanical and procedural controls restrict lift heights and load paths. Waste package lifting tools are designed so that they will not damage or mar waste package surfaces.

The trolleys are designed to be stable and maintain loads under design loading conditions, including design basis earthquakes. This requirement is met by rail and trolley design, limiting the speed, and providing restraints on the load.

System reliability features such as preferred failure modes or fail-safe positions, as well as redundant subsystems or components, will be defined as the design progresses. Such features will be incorporated into the design based on standard industry practices including codes and standards and reliability analyses, such as failure mode and effects analysis (FMEA), during the design of critical equipment and components.

4.1.6 System Control Features

The description, functions, and requirements for the control systems are part of the digital control and management information system. Details of this system are presented in the system design documentation. Monitoring and supervisory control are provided on consoles in the single repository site control room. Monitoring and full control are provided by control interfaces local to the operation.

The system control features, including system monitoring controls; control capability and locations; automatic and manual actions; set points and ranges, and mechanical end stops; limit switches and interlocks; bypasses and permissibles are part of the detailed system design.

The definition of control modes has yet to be determined. Additional information will be provided as the detailed design matures.

4.2 OPERATIONS

The following sections provide an overview of the Cask/MSC/WP preparation operations. Specific operational actions, scope of inspections, acceptance criteria, radiological controls, ALARA procedures and other operations controlling documents will be defined in procedures, inspection plans and procedures, radiological work permits, environmental health and safety plans, and other controlling documents prepared by the operating contractor.

Conduct of operations and specific operational actions for the system, such as shift turnover and system status information, will be developed prior to facility operation.

4.2.1 Initial Configuration (Prestartup)

Initial configuration activities will be performed prior to startup to ensure that appropriate management and safety procedures and protocols are in place.

- Checking maintenance records to ensure testing and inspection have been performed in accordance with approved procedures
- Checking completion of SSCs following maintenance activities to verify "return to service"
- Verifying safety significant SSCs as specified in the Yucca Mountain Safety Analysis Report
- Confirming operator training qualification records.

Details of these activities are not developed at this time. Additional details will be provided in this section of the SDD as the design matures.

4.2.2 System Startup

This section will be completed following design completion. It will summarize the key steps in starting up the facility systems, including sequencing, timing, prerequisites for the next step, and determining success rate of startup, including references to the governing procedures. At this time, general information is provided in these sections with details to be provided after design completion.

Readiness reviews will be conducted to ensure that objective evidence exists demonstrating satisfaction of work prerequisites, training and qualifying of personnel, and the availability of approved, detailed implementing documents and management controls.

A series of NRC inspection and oversight dry runs will be conducted and monitored by the NRC as initial startup activity.

4.2.3 Normal Operations

4.2.3.1 Dry Transfer Facility

4.2.3.1.1 Cask Preparation Subsystem

- **Loaded Transportation Casks**

  The cask and MSC entrance vestibule (Room 1079) is secured and the outer door is opened allowing a SRTCs carrying a loaded transportation cask with impact limiters and personnel barriers, if applicable, to enter. The outer doors are closed and the door to cask and MSC SRTC receipt area (Room 1077) is opened. The SRTC is moved into Room 1077. Handling tools required for the type of cask to be received are prestaged. A radiological survey is performed on the cask upon arrival. The impact limiters and

personnel barriers, if applicable, are unbolted and the 25-ton material handling crane removes the items and stages them adjacent to the SRTC. Additional inspections and radiological surveys are performed on the cask and impact limiters surfaces that were inaccessible. A forklift then moves the impact limiters and personnel barriers, if applicable, to storage locations within Room 1079.

A cask trolley is prepared with the appropriate pedestal and hold-down devices for the specific transportation cask by the 5-ton cask pedestal gantry crane and is staged in the cask and MSC to trolley transfer room (Room 1076). The door to Room 1076 is opened. The 200-ton cask handling crane upends the transportation cask by the upper trunnion or fixture, from a horizontal to vertical position on the trolley and moves the cask from Room 1077 to the trolley in Room 1076. The crane places the transportation cask on the pedestal in the trolley and hold-down devices are fastened to the cask to secure it in place. During these operations, mechanical and administrative controls are used to restrict lift heights and load paths. Energy absorbing crush pads are also used to ensure that cask design bases for a postulated drop are not exceeded.

The 200-ton cask handling crane is now detached and the door to Room 1076 is closed. An operator initiates automatic control with operator validation from a local workstation, which closes the Room 1076 door and opens the shield door to Room 1073, the cask trolley moves into the Cask/MSC turntable room (Room 1073). The shield door closes after the trolley enters and the turntable rotates to align its tracks with the tracks leading into the cask preparation room (Room 1074). The shield door opens to Room 1074 and the trolley moves the cask preparation room (Room 1074). The shield door then closes.

The transportation cask is prepared manually for unloading. Personnel at shielded workstations above Room 1074 in the cask preparation work station (Room 2059) perform gas-sampling operations on the cask, which may vary between cask designs. For a cask with a double lid design, after removing the outer lid, personnel check and sample the interior cask pressure and vent the cask interior according to the cask specific procedures. Personnel then remove the inner lid bolts and install the lid lifting fixture and the cask-docking ring. For a cask with single-lid design, personnel check and sample the interior cask pressure and gas before removing the lid bolts then install the lid lifting fixture and the docking ring with the 20-ton cask docking ring crane. Gas sampling results are analyzed and based on the results the cask may be sent to the remediation system for further evaluation. The levelness of the docking ring sealing surface is verified and adjusted as necessary. Sufficient lid bolts are left engaged to prevent the lid from coming off during cask transfer.

When the cask is ready for unloading, the cask trolley is placed back in automatic control with operator validation. The shield door to Room 1073 is opened and the trolley is moved back onto the turntable and the shield door is closed. The turntable aligns to the rails leading to the cask and MSC docking room (Room 1069). The shield doors are opened and the trolley moves onto the turntable in Room 1069 and the shield door is closed. The turntable aligns to the rails leading to the selected cask docking port,

where the trolley positions the cask under the docking port. The SNF/HLW transfer system performs actual docking of the cask to the waste transfer cell.

- **Loaded Site-Specific Casks (Incoming)**

  Loaded site-specific casks are prepared for waste transfer operations in a similar manner as that of loaded transportation casks and in the same locations, except that loaded site-specific casks are received in the DTF entrance vestibule in a vertical position by a site-specific cask transporter. Therefore there are no upending operations.

- **Loaded DPC Transportation Casks**

  DPC casks are prepared for unloading in a similar manner as that of other transportation casks but in different locations and include additional processes for preparing the DPC.

  After the DPC transportation cask is transferred to a cask trolley in the cask and MSC to trolley transfer room (Room 1076), the trolley automatically moves into the Cask/MSC turntable room (Room 1073). In this room, the turntable directs the trolley toward the cask preparation room (Room 1074), which it passes through en route to the DPC preparation/cask dry remediation cell (Room 1100). This cell is a separate room that contains mechanical handling equipment and tools necessary for preparing DPC casks. Shield doors automatically open and close and the turntable automatically align to the proper set of rails, based on the destination chosen by the operator.

  The internal atmosphere of the transportation cask is gas sampled, vented, and the cask lid bolts and lid are removed. A lifting fixture is attached to the DPC and the docking rings are installed from the DPC preparation station (Room 2057). The trolley moves the DPC cask to the DPC docking room (Room 1101), where the DPC cask is positioned under the docking station of the DPC cutting/waste package dry remediation cell (Room 1097). Actual docking of the DPC cask to the DPC cutting/waste package dry remediation cell (Room 1097) is performed by the SNF/HLW transfer system.

- **Loaded Naval Casks**

  The waste package and naval entrance vestibule (Room 1060) is secured and the outer door is opened allowing an SRTC carrying a loaded naval cask with installed impact limiters and personnel barrier to enter. The door to waste package/naval cask SRTC Receipt Area (Room 1058) is opened and the SRTC is moved into position. The 50-ton waste package handling crane removes the personnel barrier and impact limiters. Surveys are completed on uncovered areas. In the waste package/naval to trolley transfer room (Room 1057), a cask trolley is prepared with the correct pedestal using the jib crane. The confinement door between Room 1057 and Room 1058 is opened and the 200-ton naval cask handling crane upends the naval cask from a horizontal to vertical position on the SRTC in Room 1058 and transfers it to the prepared waste package trolley. The confinement door is closed and the door to the waste package/naval cask preparation room (Room 1053) is opened. The trolley and naval cask automatically move to the waste package/naval cask preparation room (Room 1058), where the

internal atmosphere of the cask is sampled, vented according to the naval cask procedures, and lid bolts are removed and the lid-lifting fixture is installed.

The trolley and naval cask moves through the waste package docking cell (Room 1052) to the waste package loading (naval canister)/docking ring removal cell (Room 1051), where the naval cask is positioned. The SNF/HLW transfer system performs the canister transfer operations.

- **Empty Site-Specific Cask**

  The cask and MSC entrance vestibule (Room 1079) is secured and the outer door is opened allowing a SRTC carrying an empty site-specific cask to enter. The outer doors are closed and the door to cask and MSC SRTC receipt area (Room 1077) is opened. The SRTC is moved in Room 1077. Handling tools required for the type of cask to be received are pre-staged.

  A cask trolley is prepared with the appropriate pedestal and hold-down devices for the specific site-specific cask by the 5-ton cask pedestal gantry crane and is staged in the cask and MSC to trolley transfer room (Room 1076). The door to Room 1076 is opened. The 200-ton cask handling crane upends the site-specific cask by the upper trunnion from a horizontal to vertical position on the trolley and moves the cask from Room 1077 to the trolley in Room 1076. The crane places the site-specific cask on the pedestal and the trolley and hold-down devices are fastened to the cask to secure it in place.

  The 200-ton cask handling crane is detached and an operator initiates automatic control with operator validation from a local workstation, which closes Room 1076 door and opens the shield door to Room 1073 and moves the cask trolley into the Cask/MSC turntable room (Room 1073). The shield door closes after the trolley enters and the turntable rotates to align its tracks with the tracks leading into the cask preparation room (Room 1074). The shield door opens to Room 1074 and the trolley moves in the cask preparation room (Room 1074). The shield door then closes. The site-specific cask lid bolts are removed and the site-specific cask docking ring is installed.

  When the site-specific cask is ready for loading, the cask trolley is placed back in automatic control with operator validation. The shield door to Room 1073 is opened and the trolley is moved back onto the turntable and the shield door is closed. The turntable aligns to the rails leading to the cask and MSC docking room (Room 1069). The shield door is opened and the trolley moves onto the turntable in Room 1069 and the shield door is closed. The turntable aligns to the rails leading to the selected cask docking port, where the trolley positions the cask under the docking port. The SNF/HLW transfer system performs the actual docking of the site-specific cask to the waste transfer cell.

- **Unloaded Site-Specific Cask (*Incoming*)**

  Unloaded site-specific casks are prepared for waste transfer operations in a similar manner as that of empty site-specific casks and in the same locations, except unloaded site-specific casks are received in the DTF entrance vestibule in a vertical position by a site-specific cask transporter. Therefore no upending operations are required.

4.2.3.1.2 Waste Package Preparation Subsystem

- **Empty Waste Package**

  The waste package and naval entrance vestibule (Room 1060) is secured and the outer door is opened allowing a SRTC carrying an empty waste package to enter on one of two waste package processing lines. The door to either the waste package SRTC receipt area (Room 1059) or the waste package/naval cask SRTC receipt area (Room 1058) is opened and the SRTC enters. Handling tools required for the specific type of waste package to be received are pre-staged. The middle and outer lids of the waste package are taken to a waste package closure cell.

  The prepared waste package trolley moves in the waste package/naval to trolley transfer room (Room 1057). The confinement door between Room 1057 and Room 1058 or Room 1059 is opened and the 50-ton waste package handling crane lifts the waste package from the SRTC and moves it into Room 1057. The crane places the waste package on the prepared waste package trolley and secures the waste package with the hold-down devices.

  The 50-ton waste package handling crane is detached and returns to the waste package receipt area (Room 1058 or Room 1059). The waste package to trolley transfer room door is closed and confinement established. The operator initiates automatic control with operator validation, which opens the shield door leading to the waste package/naval cask preparation room (Room 1053) or the waste package preparation room (Room 1056) depending on which waste package processing line is being used. The trolley enters, the shield door closing behind, and the waste package is prepared from an area above (Room 2050). The waste package docking ring is installed.

  The operator resumes automatic control with operator validation, which opens the shield door leading to the waste package docking cell (Rooms 1055 or 1052) then moves the waste package trolley and waste package to position under the docking port. The SNF/HLW transfer system performs docking of the waste package to the transfer cell.

  For naval canister transfer, no docking ring is installed. The waste package on its trolley is positioned in the waste package loading/docking ring removal cell (Room 1054) for transfer of a naval canister from the naval cask located in Room 1051.

4.2.3.1.3 Cask Restoration Subsystem

- **Unloaded Transportation Casks**

  After the transportation cask is unloaded, and the cask lid is installed, the transportation cask is undocked from the docking port. The undocking operation is performed by the SNF/HLW transfer system.

  The operator at the workstation initiates automatic control with operator validation to move the trolley to the turntable in the cask and MSC docking room (Room 1069). The shield door is opened and the trolley moves to the Cask/MSC turntable room (Room 1073) and moves into the cask restoration room (Room 1072). Shield doors automatically open and close and the turntable automatically align to the proper set of rails, based on the destination chosen by the operator.

  Cask restoration is performed manually via access from above the cask on a platform in Room 1072. Specific activities include removing the docking ring, which are sent to the docking ring decontamination area before being returned to their dedicated storage area; installing and bolting lid(s) if necessary; testing for leaks; and conducting radiological surveys to ensure the cask can be released.

  After restoration is completed, the operator initiates automatic control with operator validation, which moves the cask and cask trolley to Room 1073. Shield doors automatically open and close and the turntable automatically align to the proper set of rails, based on the destination chosen by the operator. From there, the trolley and cask move to the cask and MSC to trolley transfer room (Room 1076). The confinement door opens and the 200-ton cask handling crane moves the cask from the trolley to a SRTC in the cask and MSC SRTC receipt area (1077) and changes the position from vertical to horizontal. The 25-ton material handling crane and forklift retrieve impact limiters and personnel barriers, if applicable, from the storage area for installation. Radiological surveys are conducted to ensure the cask can be released from the DTF. Following the surveys and decontamination, as necessary, the SRTC and cask moves through the cask and MSC entrance vestibule (Room 1079) to the cask receipt and return system.

- **Unloaded DPC Transportation Cask**

  Unloaded DPC casks are moved from the DPC docking room (Room 1101) to the cask restoration room (Room 1072) and are handled in a similar manner as that of other transportation casks during cask restoration operations.

- **Unloaded Naval Cask**

  Unloaded naval casks are moved from the waste package loading (naval canister)/docking ring removal cell (Room 1051) to the waste package/naval cask preparation room (Room 1053) and are handled in a similar manner as that of other transportation casks during cask restoration operations.

- **Unloaded Site-Specific Cask**

  Unloaded site-specific casks are moved from the cask and MSC docking room (Room 1069) to the cask restoration room (Room 1072) and handled in a similar manner as that of other transportation casks.

- **Loaded Site-Specific Cask (*Outgoing*)**

  The shield door is opened and the loaded site-specific casks are moved from the cask and MSC docking room (Room 1069) to the Cask/MSC turntable room (Room 1073). The tracks aligned to the cask restoration room (Room 1072). The shield door is opened and the trolley enters Room 1072 where the lid is secured, the lift fixture is removed and the cask cavity is leak tested and inerted. The door is opened and the trolley enters Room 1073. The tracks are aligned to the cask and MSC to trolley transfer room (Room 1076). The shield doors are opened and the trolley enters Room 1076 and the shield doors are closed. The confinement door is opened and the 200-ton cask handling crane is attached. The loaded site-specific cask is placed on the lay down area in the cask and MSC SRTC receipt area (Room 1077) for retrieval by the site-specific cask transporter and moved to the SNF aging system.

4.2.3.2 Canister Handling Facility

4.2.3.2.1 Cask Preparation Subsystem

- **Loaded Transportation Cask**

  The entrance vestibule (Room 1036) is secured and the outer door is opened allowing a SRTC, LWT, or OWT carrying loaded transportation cask to enter. Prior to receiving transportation casks, the appropriate handling tools, pit pedestals, and impact limiters are staged.

  Impact limiters and personnel barriers are removed, as necessary, using the 20-ton entrance vestibule crane. The cask is inspected for damage and radiological surveys will be performed, as required. The roll up door to Room 1035 and the shield door to Room 1033 is opened in turn and the conveyance is moved into the canister transfer cell (Room 1033). The shielded pit cover is removed and an appropriate pedestal is placed in the pit using the 200-ton cask handling crane auxiliary hook. The lifting yoke is configured and attached to the 200-ton cask handling crane. Tiedowns and stabilizers are removed, the crane is positioned and the cask is upended. It is then lifted and positioned in the cask preparation pit. The shield door is closed. A pit movable platform is placed over the cask preparation pit (P0002). The cask cavity gas is sampled. If the gas sample results are not acceptable, the cask is processed for return to the cask receipt and return system. If the gas sample results are acceptable, the cask internal pressure is equalized to atmospheric pressure and the cask bolts are removed.

  Prior to removing a transportation cask lid, the proper lid-lifting fixture is attached to the lid. The grapple for transferring the cask lid and canisters is installed on the 100-ton

crane. For a transportation cask containing a naval canister or vertical DPC, an additional step is required after the transportation cask lid is removed. A lift fixture with pintle is attached to the top of the naval canister or vertical DPC so that the grapple can remotely lift the canister. Personnel entry can occur during different stages of the process to change out grapples and yokes if necessary when radiation sources are shielded. The cask is then ready for transferring canisters to a waste package.

- **Empty Site-Specific Cask**

The entrance vestibule (Room 1036) is secured and the outer door is opened allowing a SRTC carrying empty site-specific cask to enter and the outer door is closed. Prior to receiving empty site-specific casks, the appropriate handling tools and pit pedestals are staged. The roll-up door to Room 1035 and shield door to Room 1033 are opened in turn, the SRTC is moved into the canister transfer cell (Room 1033), then the shield door is closed. The shield plug from the waste package/MSC pit is removed. The cask handling crane lifting yoke is changed to the lifting yoke for the site-specific cask. The empty/unloaded site-specific cask is upended and placed in the waste package/MSC pit. The mobile platform is positioned over the MSC pit. The lid bolts are loosened and removed; a lid grapple is attached to the 200-ton cask handling crane; and the empty/unloaded site-specific cask lid is removed. The SRTC leaves the facility in an opposite manor.

- **Unloaded Site-Specific Cask (*Incoming*)**

The preparation operations for an unloaded site-specific cask are the same as an empty site-specific cask except; unloaded site-specific casks are received from the SNF aging system outside the entrance vestibule in a vertical position and placed on a rail conveyance. The outer doors are opened and the conveyance is moved into the entrance vestibule (Room 1036).

4.2.3.2.2 Waste Package Preparation Subsystem

- **Empty Waste Package**

The entrance vestibule (Room 1036) is secured and the outer door is opened allowing a SRTC carrying an empty waste package to enter. Prior to receiving an empty waste package, the appropriate handling tools for the specific type of waste package are staged. The waste package is delivered with the inner lid in place. The waste package middle and outer lids are removed form the SRTC, secured to a pallet, and a forklift moves them to the waste package closure cell. The outer door to the entrance vestibule is closed, the roll up door to Room 1035 and shield door to Room 1033 are opened in turn, and the SRTC is moved into the canister transfer cell (Room 1033). The shield door is closed. The shielded pit covers are removed and an appropriate impact limiter and pedestal is placed in the pit (P003 or P004) using the 100-ton waste package and canister handling crane auxiliary hook. The 100-ton waste package and canister handling crane and the waste package lifting yoke are used to lift the empty waste package and place it in a waste package/MSC loading pit (P003 or P004). A lid grapple is attached to the

100-ton waste package and canister handling crane; and the inner waste package lid is removed. The SRTC leaves the facility in an opposite manner.

4.2.3.2.3 Cask Restoration Subsystem

- **Unloaded Transportation Cask**

  Cask restoration activities are manual local operations. Unloaded cask lid(s) are installed, bolted, a leak test is performed on the cask, and radiological surveys are performed.

  An SRTC, LWT, or OWT is moved back into the canister transfer cell (Room 1033). The transportation cask is lifted out of the pit and placed back onto a SRTC using the 200-ton cask handling crane. Transportation casks are lowered to a horizontal position. Radiation and contamination surveys are performed.

  The transportation cask and SRTC are moved out of Room 1033 and back to the entrance vestibule (Room 1036). The impact limiters and personnel barrier are retrieved from the storage area and installed on the transportation cask using the 20-ton entrance vestibule crane. Exit radiation and contamination surveys are performed and the empty transportation cask and SRTC are returned to the cask receipt and return system.

- **Unloaded Site-Specific Cask**

  The site-specific cask lid is placed on the unloaded site-specific cask. The mobile platform is positioned over the MSC pit. The lid bolts are installed and torqued onto the cask. The mobile platform is removed; and the cask lifting yoke on the 200-ton cask handling crane is installed. The unloaded site-specific cask is lifted from the MSC pit; the cask is placed onto a rail conveyance in the vertical orientation and moved through the entrance vestibule (Room 1036) to the SNF aging system.

- **Loaded Site-Specific Cask (*Outgoing*)**

  The site-specific cask lid is placed on the loaded site-specific cask. The mobile platform is positioned over the MSC pit. The lid bolts are installed and torqued onto the cask. For metallic site-specific cask the cask cavity is leak tested and inerted (inerting is not required for non metallic site-specific cask; this mobile platform is removed; and the cask lifting yoke on the 200-ton cask handling crane is installed. The loaded site-specific cask is lifted from the MSC pit; the cask is placed onto an SRTC and moved through the entrance vestibule (Room 1036) to the SNF aging system.

4.2.3.3 Fuel Handling Facility

4.2.3.3.1 Cask Preparation Subsystem

- **Loaded Transportation Casks**

  The entrance vestibule (Room 1001) is secured and the outer door is opened allowing a railcar or truck trailer carrying loaded transportation casks to enter and the outer door is closed. Prior to receiving transportation casks, the appropriate handling tools are staged. The 30-ton auxiliary hoist on the 200-ton entrance vestibule crane is used to remove the personnel barriers and impact limiters, as applicable. Inspections and radiological surveys are performed on the casks and impact limiters. The import-export trolley is prepared with hold-down devices and pedestals appropriate for the type of cask to be unloaded. Using the 200-ton entrance vestibule crane, casks are upended, moved to the trolley and secured.

  The outer shield door to the preparation room (Room 1002) is opened, the loaded trolley is moved into Room 1002 and the outer shield door is closed. Specific tools are used to remove the cask outer lid bolts and lid (as required). Prior to detorquing the lid bolts, the cask cavity gas is sampled. If the gas sample results are not acceptable, the results are noted for further processing. After sampling the cask, the internal pressure is equalized to atmospheric pressure and the cask bolts are removed. The inner lid bolts are removed (leaving sufficient bolts engaged to prevent the lid from coming off during transfer), and a lifting fixture is installed.

  The inner shield door to Room 1003 is opened; the loaded transportation cask on the import-export trolley is moved to the main transfer room (Room 1003). Transportation casks containing canistered waste are moved from the import-export trolley to the canister transfer station using the 200-ton main transfer room crane. The 200-ton main transfer room crane is disengaged from the cask.

  Transportation casks containing uncanistered SNF are moved from the import-export trolley to a transfer trolley outfitted with the appropriate pedestal using the 200-ton main transfer room crane. When casks are being moved from the import-export trolley to the transfer trolley, lift heights and load paths are restricted. The 200-ton main transfer room crane is detached, a docking ring is installed making the cask ready for transfer operations. The fuel transfer bay (Room 1005 or 1006) shield door is opened, the transfer trolley is moved to the transfer bay beneath the fuel transfer room (Room 2001), the cask is positioned under the docking ports and the shield door is closed. Docking of the transportation cask to the fuel transfer room is performed by the SNF/HLW transfer system.

- **Loaded Site-Specific Casks *(Incoming)***

  The operations for site-specific casks are similar to those for transportation casks; except that there are no impact limiters or personnel barriers and the casks are received from the SNF aging system in a vertical position outside the entrance vestibule. The exterior

doors are opened and the 200-ton vestibule gantry crane exits the vestibule to retrieve the site-specific cask. Inside the entrance vestibule, the 200-ton entrance vestibule crane places the site-specific cask onto the prepared import-export trolley.

- **Empty Site-Specific Cask**

  The entrance vestibule (Room 1001) is secured and the outer door is opened allowing a railcar or truck trailer carrying an empty site-specific cask to enter and the outer door is closed. Prior to receiving an empty site-specific cask, the appropriate handling tools are staged. The FHF will accept an empty site-specific cask directly from off-site prior to having the Non-Nuclear Handling Facility on line. The empty site-specific cask will be delivered to the entrance vestibule where tie-downs and shipping protection are removed and receipt inspection is performed.

  The import-export trolley is prepared with the appropriate pedestal and hold-down devices for the site-specific cask. The 200-ton entrance vestibule crane is used to upend and transfer the site-specific cask to the import-export trolley. The site-specific cask is placed on the pedestal and secured in place.

  The outer shield door is opened and the import-export trolley is moved into the preparation room (Room 1002). The outer shield door is closed and manual operations are performed on the site-specific cask to prepare it for transfer from the main transfer crane maintenance room (Room 2013) located above Room 1002. Lifting fixtures specific to the site-specific cask are attached to the lid. The inner shield door is opened, the import-export trolley is moved into the main transfer room (Room 1003) and the shield door is closed.

  The site-specific cask is lifted from the import-export trolley using the 200-ton main transfer room crane and placed on a prepared transfer trolley. The site-specific cask is secured. The site-specific docking ring is installed. The shield doors to the site-specific cask fuel transfer bay is opened and the trolley is moved into the bay. The site-specific cask is positioned under the docking port. Docking of the site-specific cask to the fuel transfer room is performed by the SNF/HLW transfer system.

  If the material to be transferred is canistered, then the 200-ton main transfer room crane is engaged. The site-specific cask is lifted from the import-export trolley and placed in the canister transfer station. The SNF/HLW transfer system performs the canister transfer operations.

- **Unloaded Site-Specific Cask (*Incoming*)**

  The preparation operations for an unloaded site-specific cask are the same as an empty site-specific cask except; the entrance vestibule (Room 1000) door is opened and the 200-ton entrance vestibule gantry crane exits the vestibule and engages the unloaded site-specific cask, lifts and moves the unloaded site-specific cask into the entrance vestibule. Inside the entrance vestibule, the 200-ton entrance vestibule crane places the site-specific cask onto a prepared import-export trolley.

4.2.3.3.2 Waste Package Preparation Subsystem

- **Empty Waste Packages**

The entrance vestibule (Room 1001) is secured and the outer door is opened allowing a railcar or truck trailer carrying an empty waste package to enter and the outer door is closed. Prior to receiving an empty waste package, the appropriate handling tools are staged. The FHF will accept waste packages directly from off-site prior to having the Non-Nuclear Handling Facility on line. The waste package will be delivered to the entrance vestibule where the shipping protection and tie-downs will be removed. The waste package will be transferred by slings to the trunnion collar installation machine where receipt inspection is performed. Trunnion collars are installed and the waste package is upended. The 200-ton entrance vestibule crane is used to place the waste package on the import-export trolley. The waste package is secured in place on the pedestal and the crane is detached. The inner lid and spread ring is installed within the waste package.

When the Non-Nuclear Handling Facility is on line, the waste package is delivered with the inner lid in place and on the transport in the vertical position.

The middle and outer waste package lids are secured to a pallet and moved to the waste package closure room (Room 2008).

The outer shield door is opened and the import-export trolley is moved into the preparation room (Room 1002). The outer shield door is closed and local manual operations are performed on the waste package to prepare it for transfer. The inner shield door is opened, the import-export trolley is moved into the main transfer room (Room 1003) and the shield door is closed.

The 200-ton main transfer room crane is engaged to the waste package. The waste package is lifted from the import-export trolley and placed on a prepared transfer trolley. The docking ring is installed. The shield doors to the Fuel Transfer Bay #1 (Room 1004) are opened and the trolley is moved into the bay. The waste package is positioned under the docking port. The SNF/HLW transfer system performs docking of waste packages to the fuel transfer room.

If the material to be transferred is a canistered waste package, then the 200-ton main transfer room crane is engaged to the waste package. The waste package is lifted from the import-export trolley and placed in the canister transfer station. The SNF/HLW transfer system performs the canister transfer operations.

4.2.3.3.3 Cask Restoration Subsystem

- **Unloaded Transportation Cask**

After separation from the docking port, the transfer bay shield door opens as the transfer trolley moves from the fuel transfer bay to the main transfer room (Room 1003). The shield door is closed.

In Room 1003, docking rings are removed manually with a grapple device and placed on a storage rack. Transportation casks are moved from transfer trolleys to the import-export trolley using the 200-ton main transfer room crane. Transportation casks coming from the canister transfer station are moved directly to the import-export trolley using the same crane. The import-export trolley and cask are moved through the inner shield doors into the preparation room (Room 1002) and the inner shield doors are closed. The inner cask lid is fully bolted and if the cask has an outer lid it is installed and bolted. Radiological surveys and decontamination are performed, as applicable, on the casks to ensure that they can be released for subsequent operations.

The outer shield doors open and the import-export trolley and cask move into the entrance vestibule (Room 1001). The 200-ton entrance vestibule crane is used to lift the cask from the trolley to the conveyance. Impact limiters and personnel barriers are retrieved from the vestibule storage area and reinstalled using the 30-ton auxiliary hoist. Radiological surveys are performed to ensure that the cask can be released for off site shipment. The cask tie-downs and associated equipment are reinstalled on the cask.

- **Loaded Site-Specific Casks**

  The loaded site-specific cask is undocked from the fuel transfer bay. The shield doors of the fuel transfer bay are opened and the trolley and cask are moved into the main transfer room (Room 1003). The docking ring is removed, the cask lid is secured, and the 200-ton main transfer room crane lifts the cask from the transfer trolley to the import-export trolley. For a site-specific cask coming from the canister transfer station, the cask lid is secured and moved directly to the import-export trolley using the same crane. The inner shield doors are opened, the trolley and cask are moved inside the preparation room (Room 1002) and the inner shield doors are closed. The remaining lid bolts are inserted and torqued. The trolley and cask are surveyed for radiological contamination and decontaminated, if necessary. The interior of the site-specific cask is inerted. The outer shield doors are opened and the trolley and cask are moved into the entrance vestibule (Room 1001). Loaded site-specific casks are transferred outside of the FHF and set on a pad (using the entrance vestibule crane) for transfer to the SNF aging system.

- **Unloaded Site-Specific Casks**

  The restoration of unloaded site-specific casks is performed in a similar manner and in the same location as unloaded transportation casks. Unloaded site-specific casks are moved to the SNF aging system.

4.2.4 Off-Normal Operations

System operations shall be reviewed and potential event sequences will be identified. The monitoring and control of the systems shall be sufficient so that off-normal conditions that could lead to events are identified such that actions (either automatic or manual) to prevent or mitigate the condition can be initiated. Procedures will be developed to ensure proper response to the

off-normal condition, operations personnel shall be trained, and sufficient staff shall be available to handle these conditions.

SSCs require evaluation for off-normal conditions using reliability analyses (e.g., FMEA, fault trees). Since the preliminary design for the Yucca Mountain Project is not complete, key equipment features are assessed against similar designs for preliminary reliability analyses with respect to off-normal conditions.

In general, equipment is analyzed for potential consequences and the events narrowed down to those which are ITS. The results of the FMEAs or other reliability analyses will be considered as the design matures to ensure the ITS SSCs meet their nuclear safety bases requirements.

4.2.5 System Shutdown

System shutdown procedures, standby procedures, and monitoring procedures will be developed for the Cask/MSC/WP preparation system as the design matures.

4.2.6 Safety Management Programs and Administrative Controls

The safety management programs and administrative controls invoked on the system ensure that the performance objectives of 10 CFR Part 63 [DIRS 173164] are met.

Safety management programs are adapted to cover any unique aspects required to ensure the safety of system specific equipment or components. The safety management programs apply to systems to ensure that the ITS SSCs will be available when required to perform their safety function or do not prevent an ITS SSC from performing its safety function.

Examples of safety management programs are:

- Quality assurance
- Configuration management
- Maintenance
- Training and qualification of plant personnel
- Procedures
- Audits and assessments
- Incident investigations
- Records management
- Radiation control program.

Safety analysis requires that certain system operations be controlled such that operations remain within the analysis of the events involving the system. As such, administrative controls are imposed on system operations and maintenance to ensure that the system is operated within the bounds of the safety analysis. Administrative controls that need to be imposed on the operations and maintenance of the system will be described in detail as the design progresses.

4.3 TESTING AND MAINTENANCE

4.3.1 Temporary Configurations

Separate testing and maintenance programs, and temporary configurations will be developed for the Cask/MSC/WP preparation system. Details are not developed yet. This section of the SDD will be revised as the design matures.

4.3.2 Safety Required Surveillances

These requirements will be based on the final system configuration and its contribution to preclosure and postclosure performance objectives. A review of these considerations will establish the set of necessary surveillance, inspections, and testing requirements. No surveillances, inspections, and testing requirements have been identified at this time. This section of the SDD will be revised as the design process matures.

4.3.3 Non-Safety Inspections and Testing

Procedures will be developed to define and describe surveillances, inspections, and testing requirements. The procedures will be based on manufacturer recommendations and final system configuration.

4.3.4 Maintenance

- **Equipment Inside a Hot Cell**

  The principles for the maintenance of equipment installed in the hot cells is to use in-cell cranes, remote master/slave manipulators and, possibly, specific tools operated from an adjacent room. Damaged pieces of equipment are removed by the in-cell crane with or without support of the master/slave manipulators and sent to the crane park cell where they are repaired or disposed of as waste. New pieces of equipment are also introduced in the process cell through the crane park cell. Only limited maintenance can be performed in the crane park cell.

  In case of failure of a master/slave manipulator, it is removed following specific procedures. The failed manipulators are transported to the manipulator repair room (Room 2044).

- **Equipment Outside a Hot Cell**

  The principles for the maintenance of equipment installed outside a hot cell will be maintained hands-on by maintenance personnel.

  The design process needs to progress further in order to identify maintenance requirements and a maintenance program for the Cask/MSC/WP preparation system SSCs. The maintenance program for this system will be developed as part of the repository maintenance program.

Implementation of Maintenance Program

Analysis of critical SSCs is to be performed for categorization and implementation. The relationship of SSCs in a maintenance program is documented in the DOE maintenance program outlined in DOE Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities* (DOE 2001 [DIRS 163898]). Service cycles for each piece of equipment will be determined with collaboration of specific manufacturers/vendors.

The maintenance for individual SSCs requires a thorough systematic evaluation to maintain a level of safety and reliability within the system. An assembly of actions, which ensure continued operation of equipment within given tolerances and performance measures, constitutes maintenance. Related maintenance documentation will satisfy correct equipment line-up, setup, and preparation, and provide a record of operation to traceable performance tolerances.

The preventive maintenance principle can be characterized as systematic or conditional. Systematic maintenance is a process by which consumables are routinely changed after a given number of operating cycles. Conditional maintenance is a process by which any given SSC is diagnosed for wear and tear and evaluated against performance tolerances. The corrective maintenance principle is simply the replacement or repair of failed SSCs or those that have undergone excessive wear and tear.

Under this principle, when a component has undergone replacement, it is possible to tag other similar equipment as potential candidates for conditional maintenance under the preventive maintenance principle.

Upon completion of maintenance operations, the affected SSC is characterized to be in an as-built condition. Any changes to fit, form, or function will be addressed by the modification process prior to any fieldwork.

Different system maintenance approaches for both preventive and corrective maintenance are applied depending on the equipment, its functions, operational characteristics and location within the buildings. Details of maintenance procedures based on these approaches will be available when the design and operations and maintenance procedures are complete.

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5.3 DATA TRACKING NUMBERS

No source data are cited in this document.

5.4 SOFTWARE CODES

No source data are cited in this document.

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APPENDIX A
GLOSSARY

Basis	Statements that refer to design requirements for SSCs and identify why the requirement exists, why it is specified in a particular manner, and why a specified value is used.
Design Requirement	Design requirements are technical requirements, determined by design processes that define the functions, capabilities, capacities, physical size and configurations, dimensions, performance parameters, limits, set points, and similar features of an SSC. Design requirements are developed and specified for SSCs to satisfy the mission design input requirements.
Dual Purpose Canister	A sealed metal container used to transfer, store, and transport CSNF from commercial reactor sites to the repository. The U.S. Nuclear Regulatory Commission pursuant to 10 CFR Parts 71 [DIRS 171308] and 72 [DIRS 171253] for storage and transportation licenses the container and its transportation cask. Thus, the term "dual-purpose."
Empty	Empty waste packages and empty site-specific casks refer to new or unused waste packages and site-specific casks with no radiological contamination.
Function	A function is the statement of the purpose of a system or component.
Mission Critical Requirement	Input design demands requested by the owner/client or imposed by statute or regulation that identify and define design requirements for performance, functional, operational, and maintenance characteristics/parameters that the facility SSCs are to be designed to satisfy.
Multi-Purpose Canister	A metal canister containing CSNF or other forms of HLW (e.g., HLW immobilized in vitrified-glass or SNF assemblies) that meets all applicable regulatory requirements for handling, storage, transportation, and disposal in the geologic repository.
Off-Normal	Off normal is a term used to define an occurrence of an event or condition outside the bounds of routine operations but within the range of analyzed conditions for the SSC.

Performance Acceptance Criterion	Performance acceptance criteria are statements that provide verifiable measures of how well the design specification has been achieved or limits against to which the actual performance capability of the as-built system can be evaluated.
Remediation	Remediation is a term to define a recovery strategy to recover from off-normal events involving waste packages, casks, site-specific casks, canisters, SNF/HLW and associated handling devices.
Requirements	A specification of what the design solution must do. Requirement statements should also include a statement of how well the specification is to be achieved so as to permit verification. In some cases, there are several criteria for measuring the success of the achievement of the specification and these would be listed as performance acceptance criteria.
Site-Specific Cask (MSC)	A radiation shielded vertical site-specific aging cask (steel or concrete) to accommodate three configurations of waste: 1) CSNF assemblies that are received non-canisterized, 2) Certified vertical DPC or certified multi-purpose canister containing CSNF that is received canisterized from any boiling water reactor or pressurized water reactor plants, and 3) DOE SNF/HLW canisters. (Details not yet developed. Revision of the SDD will incorporate new information as made available).
Unloaded	Unloaded refers to casks, waste packages, and site-specific casks that have been loaded with waste (used) and then unloaded. Unloaded Casks, waste packages, and site-specific casks may have radiological contamination.

APPENDIX B
LIST OF KEY SYSTEM CHARTS, DIAGRAMS, DRAWINGS, AND LISTS

Document Identifier	Title
YMP-C0115-0504 Sheet 1	*Cask/MSC/WP Preparation System Block Flow Diagram Level 2.*
YMP-C0115-0504 Sheet 2	*Cask/MSC/WP Preparation System Block Flow Diagram Level 2.*
YMP-C0115-0603 Sheet 1	*Canister Handling Facility Block Flow Diagram Level 2.*
YMP-C0115-0603 Sheet 2	*Canister Handling Facility Block Flow Diagram Level 2.*
YMP-C0115-0603 Sheet 3	*Canister Handling Facility Block Flow Diagram Level 2.*
210-MH0-FH00-00101-000	*Fuel Handling Facility Block Flow Diagram Level 2.*
210-MH0-FH00-00102-000	*Fuel Handling Facility Block Flow Diagram Level 2*
210-MH0-FH00-00103-000	*Fuel Handling Facility Block Flow Diagram Level 2.*
210-MH0-FH00-00104-000	*Fuel Handling Facility Block Flow Diagram Level 2.*
210-MH0-FH00-00105-000	*Fuel Handling Facility Block Flow Diagram Level 2.*
210-MH0-FH00-00106-000	*Fuel Handling Facility Block Flow Diagram Level 2.*
210-MH0-FH00-00107-000	*Fuel Handling Facility Block Flow Diagram Level 2.*
210-MH0-FH00-00108-000	*Fuel Handling Facility Block Flow Diagram Level 2.*
110-P10-WHS0-00101-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Legend and General Notes.*
110-P10-WHS0-00102-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Ground Floor Key Plan.*
110-P10-WHS0-00103-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Operating Floor Key Plan.*
110-P10-WHS0-00104-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Upper Floor Key Plan.*
110-P10-WHS0-00105-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Roof Key Plan.*

Document Identifier	Title
110-P10-WHS0-00108-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Ground Floor Plan A.*
110-P10-WHS0-00109-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Ground Floor Plan B.*
110-P10-WHS0-00110-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Ground Floor Plan C.*
110-P10-WHS0-00111-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Ground Floor Plan D.*
110-P10-WHS0-00112-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Operating Floor Plan A.*
110-P10-WHS0-00113-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Operating Floor Plan B.*
110-P10-WHS0-00114-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Operating Floor Plan C.*
110-P10-WHS0-00115-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Operating Floor Plan D.*
110-P10-WHS0-00116-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Upper Floor Plan A.*
110-P10-WHS0-00117-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Upper Floor Plan B.*
110-P10-WHS0-00118-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Upper Floor Plan C.*
110-P10-WHS0-00119-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Upper Floor Plan D.*
110-P10-WHS0-00120-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Roof Plan A.*
110-P10-WHS0-00121-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Roof Plan B.*
110-P10-WHS0-00122-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Roof Plan C.*

Document Identifier	Title
110-P10-WHS0-00123-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Roof Plan D.*
110-P10-WHS0-00124-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Pool Floor Plans.*
110-P10-WHS0-00128-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section A.*
110-P10-WHS0-00129-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section B.*
110-P10-WHS0-00130-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section C.*
110-P10-WHS0-00131-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section D.*
110-P10-WHS0-00132-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section E.*
110-P10-WHS0-00133-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section F.*
110-P10-WHS0-00134-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section G.*
110-P10-WHS0-00135-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section H.*
110-P10-WHS0-00136-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section J.*
110-P10-WHS0-00137-000	*Dry Transfer Facility #1/Remediaton Facility General Arrangement Section K.*
110-P10-WHS0-00138-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section L.*
110-P10-WHS0-00139-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section M.*
110-P10-WHS0-00140-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section N.*

Document Identifier	Title
110-P10-WHS0-00141-000	*Dry Transfer Facility #1/Remediation Facility General Arrangement Section P.*
110-P10-WHS0-00142-000	*Dry Transfer Facility #1 /Remediation Facility General Arrangement Section R and S.*
190-P10-CH00-00101-000	*Canister Handling Facility General Arrangement Legend and General Notes.*
190-P10-CH00-00102-000	*Canister Handling Facility General Arrangement Key Plan.*
190-P10-CH00-00103-000	*Canister Handling Facility General Arrangement Ground Floor Plan.*
190-P10-CH00-00104-000	*Canister Handling Facility General Arrangement Pit & Mezzanine Floor Plans.*
190-P10-CH00-00105-000	*Canister Handling Facility General Arrangement Second Floor Plan.*
190-P10-CH00-00106-000	*Canister Handling Facility General Arrangement Third Floor Plan.*
190-P10-CH00-00107-000	*Canister Handling Facility General Arrangement Roof Plan.*
190-P10-CH00-00108-000	*Canister Handling Facility General Arrangement Sections A & B.*
190-P10-CH00-00109-000	*Canister Handling Facility General Arrangement Section C & D.*
190-P10-CH00-00110-000	*Canister Handling Facility General Arrangement Section E.*
190-P10-CH00-00111-000	*Canister Handling Facility General Arrangement Section F & G.*
190-P10-CH00-00112-000	*Canister Handling Facility General Arrangement Section H & J.*
190-P10-CH00-00113-000	*Canister Handling Facility General Arrangement Section K & L.*
210-P10-FH00-00101-000	*Fuel Handling Facility General Arrangement Legend and General Notes.*

Document Identifier	Title
210-P10-FH00-00102-000	*Fuel Handling Facility General Arrangement Ground Floor Plan.*
210-P10-FH00-00103-000	*Fuel Handling Facility General Arrangement Operating Floor Plan.*
210-P10-FH00-00104-000	*Fuel Handling Facility General Arrangement Mezzanine Plan.*
210-P10-FH00-00105-000	*Fuel Handling Facility General Arrangement Floor Plan @ Elev +64'-0".*
210-P10-FH00-00106-000	*Fuel Handling Facility General Arrangement Plan @ Elev. 84'-0".*
210-P10-FH00-00107-000	*Fuel Handling Facility General Arrangement Roof Plan.*
210-P10-FH00-00108-000	*Fuel Handling Facility General Arrangement Section A.*
210-P10-FH00-00109-000	*Fuel Handling Facility General Arrangement Section B.*
210-P10-FH00-00110-000	*Fuel Handling Facility General Arrangement Sections C, D, & G.*
210-P10-FH00-00111-000	*Fuel Handling Facility General Arrangement Sections E, F, & H.*

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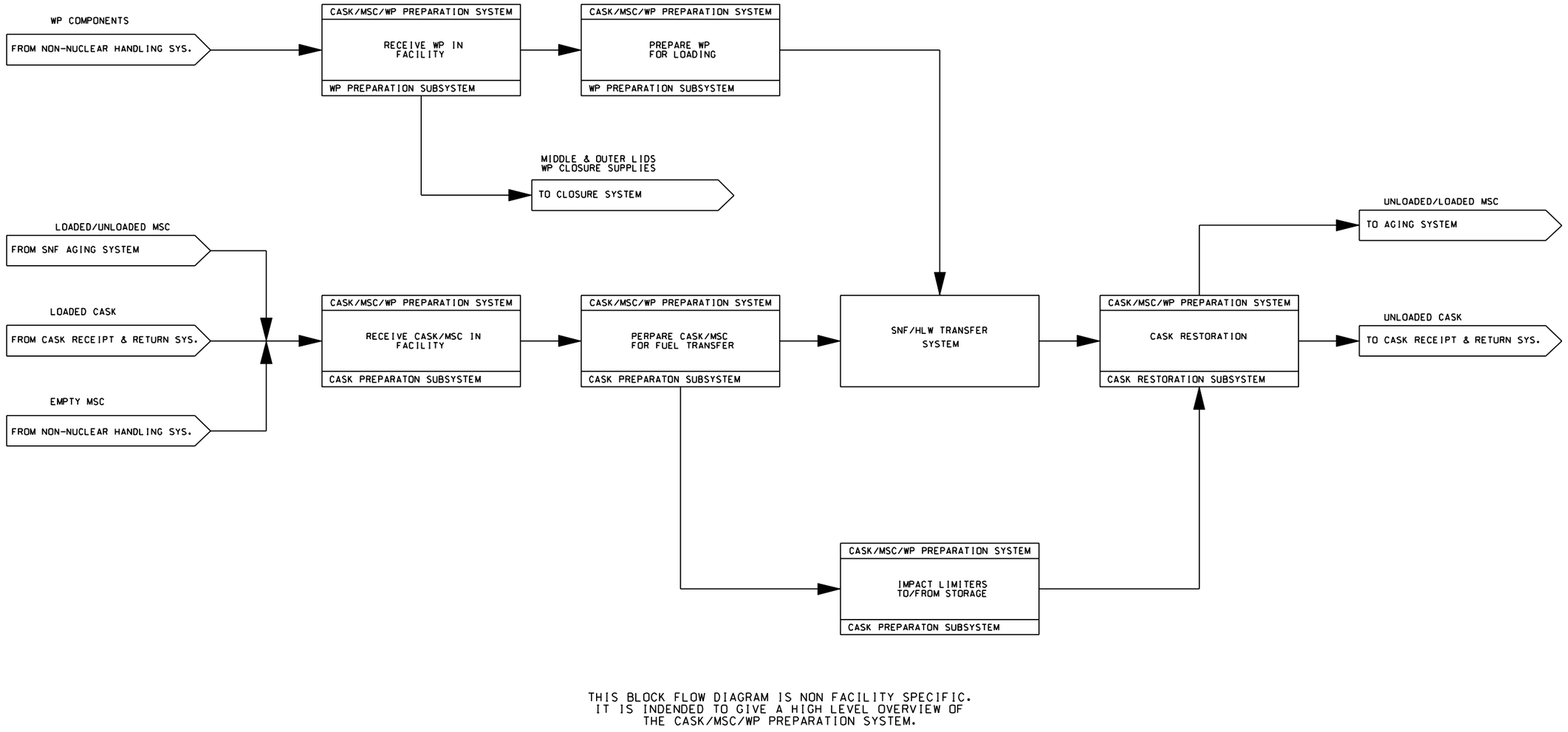

Figure B-1. Cask/MSC/WP Preparation System Block Flow Diagram

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APPENDIX C
LIST OF SYSTEM PROCEDURES

Procedures affecting the Cask/MSC/WP preparation system shall be listed in future revisions of the SDD. Detailed operating procedures will not be developed until after construction authorization.

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